

**NATURAL RESOURCES
AND
HUMAN ADAPTATION**

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By

A. M. LORENZO, M. A., Ph. D.
Lucknow University.



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DEDICATED TO

Professor Radhakamal Mukerjee,
a pioneer of "regionalism" in the various
fields of social research in India.

"Know, man hath all which Nature hath,
but more,

And in that *more* lie all his hopes
of good.

Man must begin, know this, where
Nature ends :

Nature and man can never be
fast friends,

Fool, if thou can'st not pass her,
rest her slave !"

——NEERJÄ

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PREFATORY NOTE

The story of human progress, both in space and in time, is a process of man's adaptation to his geographical milieu. The underlying idea is that the earth is a grand stage upon which mankind is playing the drama of its social history. The earth furnishes not only a setting, but numerous hidden as well as obvious resources which constitute the warp of economic toil, interwoven in rich complexity of attitude with social traditions that form the woof of a seamless web, called human society.

In the process of social evolution, human societies pass through three fundamental stages of adaptation, *viz.* Etiological, where man is merely a creature of the environment, and in adapting to its possibilities submits to his situation; Ecological, where man and region are not separate, but mutually inter-dependent entities, and man's mastery of his environment is not a one-sided transaction, but a value for value bargain; and Epharmological, where man as an active agent of his environment, rather dictates than surrenders, and so takes advantage of the physical resources as to modify his development in any desired direction. Thus, in the earlier stages, whereas man's power in nature was either *evasive* or *persuasive*, in the sense that natural powers were not overcome but merely utilized; in the present stage of telic exploitation, it is largely *pervasive*, and man today is the architect of his own destiny rather than a passive recipient of the gifts of nature.

Man's present position in nature is ascertained by his highly developed culture which helps

him to harvest the materials and forces of nature according to intention. In this highest attained stage of bio-social evolution, man, equipped with modern scientific knowledge and a highly advanced cultural apparatus, asserts his mastery over the environment of his habitat, and appropriates the resources of nature however remote or scarce. In his effort to dominate nature, by harnessing and exploiting the resources of the physical environment, man comes in direct conflict with the system of nature; and in this conflict lie the germs of progress. The greater the ascendancy of human culture, the fiercer becomes the conflict between man and nature; and the greater the intensity of conflict, the quicker is the pace of human progress.

In a planned process of active adaptation, man continuously and progressively alters the man-land ratio, and evolves new techniques of resource manipulation and utilization. On the Land-side: he increases resources by reclaiming waste-lands from forests, swamps, and the sea, by intensive cultivation and diligent selection of heavy-yielding varieties of foodgrains, by careful breeding of useful animals, by regulating rivers and controlling water-courses for irrigation, by regenerating vegetable cover and afforestation (with its regulating effect on rainfall and climate), by harnessing and distributing energy, and producing changes in the configuration of land for the development of transport and communication. On the Man-side: migrations, planned colonizations, self-control, birth-control, late marriages, and other practices have helped man to restrict the growth and distribution of population, or to equilibrate number with the available supply of resources. In either case, however, the man-land ratio is determined by the degree to which the natural resources (materials

and forces) can be effectively mobilized and utilized for worthwhile ends.

To-day, perhaps, more than at any previous period, attention is being directed to the co-operative conquest of nature by the peoples of the world. Nations, rich in natural resources, are adapting their economic institutions and policies to the new outlook in resource conservation and development; whilst those poor in resource potential aspire for colonies, spheres of influence, multilateral exchanges or guarantees for the supply of essential food-stuffs and raw materials, for building up a powerful economic state in order to secure a position of influence in the comity of nations. The geopolitical hypothesis of the two major wars reveals in unmistakable terms that international political unrest and social chaos are due to a growing disparity in world's balance of economic strength. While the immediate cause of political disturbances may be traced back to economic differences—the differences which indicate the degree of possession and control of natural resources—the remote, yet the fundamentally real, cause lies in the physico-environmental differences, which are themselves the source of all economic differences. Thus the origin of boundary disputes, territorial resettlements, economic rivalry, commercial conflicts, and such totalitarian philosophies as "Encirclement", "Lebensraum", and "Geopolitics", which ultimately foment international ill-will and lead to wars, may be found in the desire to possess and control as much of the earth's surface as is possible by persuasive diplomacy or by naked force.

If we are to understand our modern chaotic world—a world, where pillage and plunder of peaceful peoples of vegetable civilizations is considered a holy crusade for survival by peoples of

machine civilizations, where the law of the jungle preoccupies the minds of the exploitive nations, where every nation tries to possess more wealth than is necessary for its normal needs, and where the grabbed wealth is controlled by naked force and brute passion—we must recognize that war follows in sequence upon causes arising out of the disparate possession of natural resources. The complexity of modern life is such that even the close observer often fails to realize the political consequences of regional factors, and the failure to admit this fact candidly often leads to serious political errors and misguided efforts toward the establishment of enduring peace and international prosperity.

Since economic and social institutions are carved out by physico-environmental forces, and national life pulsates within its characteristic regional framework, the key to the solution of both national and international problems of modern age must be found in the equilibration of Resource Strength of various countries and peoples. To this end, a co-operative effort must be made toward the exploitation of natural resources, and their equitable distribution between the "Haves" and the "Haves-not." If the much vaunted blessings of regional specialization and multilateral exchanges are to be shared by all on an equitable basis, the resource hierarchy of the eighteenth-century Individualism, the nineteenth-century Nationalism, the mid-Victorian Imperialism, and the Autarchial concepts of the early twentieth century, must all first be ruled out of place. In a world economy of the mid-twentieth century, whose resource hierarchy rests on international *laissez faire*, neither the ambitious scheming of nationalistic statesmen designed to promote the

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selfish economic and political interests of single nationalities, nor a passive reliance on the so-called economic laws, holds out a promise of any lasting solution of present world problems. The planning of future world resource hierarchy will involve not merely a regional specialization in the rank of various economic activities, but also a complete co-operation and free economic and social intercourse between nations. When policies and forces that now operate within the sphere of individual nations, necessarily operate also between nations, peace and plenty shall descend upon man. The dismantling of the ominous geographical and racial division of the earth will, sooner or later, remove political inequality by resource equality, and usher in an era of human brotherhood and the nationality of man.

The main objective of this work, besides enlarging the body of scientific knowledge, is the interpretation of such material for students of economics and sociology as geography (physical and cultural) brings to light in explaining the course of human conduct and cultural progress. The geographer, approaching the study of economic life and social institutions from the angle of underlying physical realities, pushes upward from the physical environment toward the cultural superstructure. The economist, or the sociologist on the other hand, who explores a specific section of the cultural superstructure, probes downward toward the physical base. Somewhere the efforts of these investigators meet, not in competition but in co-operation, and here we find ourselves in the domain of Social Geography, a borderland discipline, with numerous contact points between geography, economics, and sociology. In this book I have tried to explore this border region, and to

study the physical resources on which the structure of our economic life and social institutions rests.

In dealing with the various aspects of natural resources, I have followed the Regional Method which alone seems to furnish dependable results without entailing unlimited collection and examination of factual details. Though it renders the treatment of subject somewhat abstract and speculative, the Regional Method lays due emphasis on analysis, correlation, and appraisal, and focuses attention on the whole rather than on the parts. This emphasis upon functional relationships of natural resources appears to be in line with the modern trend of economic thought, gaining importance and gradually spreading over fields of other social sciences, such as, Anthropology, Psychology, Sociology, Politics and Architecture. Naturally, therefore, in stressing the functional appraisal of natural resources, I have attempted to synthesize the findings of various social sciences, and to integrate the data readily available elsewhere. I am fully aware of the danger which is involved in trespassing on related fields, but am thoroughly convinced that such synthesis is one of the most crying needs of modern education. In presenting an *argumentum ad hominem*, I seek no apology in making my modest contribution to the advancement of Human Geography, *a fortiori*, in promoting a fuller appreciation of physical realities.

Lucknow University,
Lucknow. U. P.
India.

A. M. Lorenzo

24 August, 1947.

1

THE CONCEPT OF NATURAL RESOURCES

In the beginning, the earth was replete with a multitudinous variety of organic and inorganic materials and forces which composed the warp and the woof of Nature. But, in a man-less universe, there were no Resources.

The concept of Natural Resources, in its true perspective, developed with the emergence of Man on earth. Since man is a bundle of wants, he strives to bring the materials and forces of Nature into his own service. He judiciously manipulates them for the satisfaction of his wants, and diligently shapes them to fit in his own designs. These environmental aspects in the service of man, which enable him to appease economic wants, and to attain social objectives, are popularly termed Natural Resources. The resource concept, therefore, is relative to man and his wants.

Fundamentally, Natural Resources imply a purely subjective concept. They represent the environment *appraised* as useful to man, the environment *available* in relation to human needs and abilities, and the environment *functioning* in the process of want satisfaction. Relatively, the resource aspects of the environment vary not only according to the changing human wants, but also according to the abilities of man to utilize them. In the final analysis, however, it is the Resource

Relativity, or the functional interpretation of Resources beyond the material fixtures of the physical environment, not only in quantum and kind, but also in space and time, that gives a clue to the history of successive stages of human civilizations.

It follows, therefore, that Natural Resources comprise all materials and forces bestowed by nature upon a region, and manipulated by man according to intention. Such materials and forces, as are originally conserved by nature, whether in the form of a fund or perennial flow, include all things which are useful to man, and which can be drawn from one or more spheres of the physical environment, viz. the atmosphere (gas), the hydrosphere (water), the lithosphere (rock, the upper crust of earth), the centrosphere (inner strata of the earth which are accessible), and the biosphere (organic objects). In short, all natural things which lie within the reach of man, and can be turned to his benefit, fall in the category of Natural Resources.

In the wider sense of the term, Natural Resources are the original elements and untransformed objects of nature, such as air, water, sunshine, soil, plant, and animal life, which spontaneously satisfy human wants and are utilized as free gifts of nature. This includes, however, all substances, forces, conditions, relationships, spheres and other aspects, making up, or emanating from, the physical environment. In the narrow sense, however, only such materials and forces are included as have been actually transformed by man, and underlie shape, form, effect, structure, of that complex mixture of natural and cultural landscapes which constitute the environment of modern man. In other words, the materials and

forces which are the effect of human effort, i.e. which can be made useful and available for the satisfaction of certain basic and specific human wants, represent those forms of Natural Resources which are the economist's pure and simple wealth.

There is one aspect of the environment that never is, at least should never be, a constituent of Natural Resources, *viz.* those materials and forces which are resistant or harmful, or those which affect man's achievements neither favourably nor unfavourably. The frozen summits of the Himalayas, or the scorching depressions of the Sahara; the impregnable forests of the Congo Basin, or the unconquerable stretches of the Antarctica; the arid uplands of Pamir, or the Arctic fringes of North America—all these are largely inaccessible to modern man, because the environment is resistant or decidedly harmful for sustained effort. The energy of the sun, the storms, the river-floods, and the ocean-currents, for example, in the absence of full utilization might prove harmful, and instead of supplementing and strengthening the existing resources, deplete them or hamper their exploitation and utilization. Moreover, there are numerous aspects of the environment which lie dormant and seem of little use today, but some day they may find their place in the structure of a culturally more advanced society. Whatever is, therefore, valuable to man in view of the existing economic wants and social desires, whatever is accessible to the ingenuity of modern man, should form the basis of resource classification and assessment.

The appraisal of resource varies from time to time, and from one locality to another. It is, therefore, advisable to limit the concept to a given slice of time and a well defined area. The

value of Natural Resources varies also from the standpoint of the individual and organized social groups. One commodity-class may be essential for the existence of a people in a certain environment, while it may be of no value to another people placed in dissimilar environment. Cowrie shells, for instance, are wealth to the natives of the Andaman Islands, but mere junk to the civilized peoples of paper-money economy. Snakes and lizards are food delicacies to the forest tribes of Burma, Siam and Indo-China, but obnoxious articles of food to the Indians. Stone flints were indispensable domestic tools and cultural apparatus of the Piltdown man, but objects lacking all utility to the Aryans. Tobacco might be a necessary stimulant to a member of society (*Socius*), but tabooed by the code of society (*Organized Social Group*). In many fields private and social interests are coincident or supplementary: in others they may simply exist side by side or be antagonistic. Although in the long run the social appraisal of resources is the basis for the fulfilment of economic and social objectives, at a given time and place individual differences tend to prevail. Every change in human wants, every invention of cultural apparatus which gives a comparatively greater control over nature, every advance of co-operative social life, constantly revises the criteria of resource value, hence of resource utilization; and tends to enlarge the aggregate of available resources.

The functional interpretation of Natural Resources becomes at once comprehensible when we consider the *mutability* of natural phenomena. Since nature is a process of 'self movement,' and the key to the evolutionary series, everything is found in a state of constant flux, at one moment

in the process of stabilization, in the next of passing away. This clearly explains the resilient character of Natural Resources, which tend ceaselessly to spin and weave themselves out into new and diverse patterns. They are always moving, always changing; never stagnant, never immobile—hence conceived as living and active embodiment of the natural phenomena. Changes in Natural Resources, caused by the self-movement of nature, appear often in wave-processes, and are discernible from both quantitative and qualitative re-arrangement of substances and forces. There is thus the disappearance of the old resource patterns, and the emergence of the new, and a succession of these wave-processes evokes changes, however slow and gradual, not only in the transition of one quantity into another quantity, but also in the transition of quantity into quality, and *vice versa*.

The environmental change, with its inevitable influence on resource potential, is not a *cyclic movement* (i. e. that which is gone before and shall come again), but a *progressive flow* (indicating the reappearance of natural phenomena in new categories, never twice in the same pattern). The distribution of Natural Resources is, therefore, a development process in natural and human history. There is ample evidence that the *flows* and *changes* in nature are nothing but the transformation of resources by a process of conflict and reconciliation of opposite forces, and their emergence into more adaptable and useful patterns in keeping with the conditions of time and space. The movement of Natural Resources is a dynamic system, all parts of which, other things being equal, are constantly pulsating, i. e. expanding or contracting at proportionate rates. The resilient nature of these

parts compels them to seek a level where, at a given time and for a given purpose, there is no inducement for the parts to expand or contract. This functional position, as a whole, might be called a dynamic equilibrium, setting up a cumulative process of balancing patterns in the same resource system as between one time and another. The progressive development of resources begins first as an equilibrium in respect of one resource pattern; then that equilibrium is destroyed by the conflict of surrounding resource equilibriums, and set up anew on a fresh basis. In other words, each standing equilibrium in one slice of time becomes the starting-point for a new equilibrium in the next slice of time. Certain elements of the existing equilibrium may be included into, or deleted from, the fresh equilibrium—the resource equilibrium thus reached is, therefore, not a static condition but a progressive phenomenon. This progressive view of Natural Resources enables us to measure not merely 'fixed' resource 'situations' in the appeasement of given demands in a given slice of time, but also the degree of resource expansion in successive slices of time.

Underlying these considerations of change and development is the more fundamental view of Natural Resources, viz. that stressing their interconnection and inter-dependence. No resource pattern can be understood if taken by itself, isolated from the surrounding resource patterns, because each pattern represents an inseparable connection conditioned by surrounding phenomena. For example, the animal resource pattern is a symbiotic interpretation of the vegetable resource pattern, and therefore cannot be explained in isolation. The interdependence of one resource pattern on another maintains a balance, which

cannot be disturbed without serious economic consequences to men. Whether in the exploitation of mineral or power resources, of vegetable or animal resources, of atmospheric or hydrographical resources, the whole resource system of a region must be considered an entity and a unity, and a balance maintained between one resource pattern and another, on the one hand, and each resource pattern and the rest of the resource system, on the other. This is necessary, because, every resource consists of a number of elements (substances and forces) connected with each other, which form a certain pattern. Each such pattern is connected with other such patterns which comprise its environment. Environment and resource patterns act mutually, and react to external forces of nature. These actions and reactions lie at the root of resource development. While the source of change in any resource lies in the resource itself, the direction of movement is determined by the quantitative predominance of environing resource patterns, and the velocity of change by the impact of surrounding phenomena of nature. Consequently, Natural Resources form an ecological complex, i. e. a harmonious and reciprocal adjustment of the organic resources to the inorganic, of the whole resource system to its constituents and the surrounding phenomena. It is upon this concept that economic development and social progress of a people should be planned and executed.

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CLASSIFICATION OF RESOURCE PATTERNS

An analytical classification of Natural Resources might rest on several bases. It might follow the historical method, since it is known that primitive men first made use of vegetable materials, later domesticated animals, and finally attained, at a relatively recent time, a state of civilization in which the extensive use of minerals is the most important characteristic. It might also be a division into (1) those resources which men use as a source of energy, and (2) those used in connection with its application or production. Still another basis of classification might be the needs of the modern man which they serve. Underlying all these considerations, is the fundamental view of Natural Resources, viz. the basic materials and forces that are utilized in the satisfaction of human wants.

Human life persists through the consumption of a large variety of goods and services, which may therefore be classified into: food-stuffs, raw materials, manufactured goods, power, and certain other desirable aspects of the environment; and a proportionately greater and growing array of socialized goods and services connected with transport, education, recreation, public order, religion, and the welfare and progress of the people in general. All these resources carry

different scales of value in view of the range and variability of human needs in different places and times. They are ultimately derived from the natural environment, and cover indeed the whole field of consumption. But human needs, complex and confusing as they are, cannot form the basis of classification, because the products derived from a single source might be used for diverse purposes, e. g. vegetable products used for food, clothing or shelter. We find then, materials and forces directly appropriated and utilized from nature, e. g. air, water, sunshine; and others which have to pass through repeated transformations and modifications before they serve their final end, e. g. manufactured goods. Much of the material utilized today owes its usefulness to the way in which it satisfies mental and spiritual rather than purely physical needs.

In a narrower and less arbitrary sense, however, the want-satisfying goods may be classified into *original* (natural) and *derivative* (economic), the latter group representing the immediate source of satisfaction, the former the remote. This classification makes the distinction between Natural and Economic Resources a necessary one. Natural Resources constitute the original elements of nature, Economic Resources are mere derivations. Although certain things are consumed in the form in which nature offers them, all Natural Resources must be processed into certain forms or conditions which enable them to serve the purposes of consumption. The concept of Natural Resources is, therefore, wider than that of Economic Resources. If Natural Resources are the original source of desired things, Economic Resources are the desired things themselves. While the former is the initial potential, indicating the capacity of

a people to act or to produce effects, the latter is the effective potency, indicating the mobilized resources for satisfying specific desires. Since Natural Resources represent basic materials and forces, they can be put to diverse and multiple uses according to intention; but Economic Resources are used, as a rule, for specific purposes for which they are produced. All Natural Resources are, therefore, not Economic, whereas all Economic Resources are included in, and emanate from, Natural Resources.

Or, more precisely, Natural Resources have *esteem* value, but Economic Resources have both *esteem* and *exchange* value. For example, air, water, sunshine, etc. are *free goods*, and so long as they remain bounteous, though having esteem value, they do not enter exchange transactions. No sooner than air is compressed and stored for use by aviators at high altitudes, or solar heat harnessed for generating power, or again, water made scarce and more useful through the use of lead pipes, these free goods turn into Economic Resources by virtue of their scarcity and exchangeability. Natural Resources so transformed (in terms of utility) become at once the immediate source of consumption, i. e. they become Economic Resources. If by utility is meant *desiredness*, then everything which has exchange value has utility, while those things which having utility do not enter into exchange—because they are either free goods or cannot be transferred and appropriated—may yet be regarded as having at least a potential exchange value. The contrast between Natural Resources and Economic Resources, though apparently a contrast between esteem value, on the one hand, and exchange value, on the other, is really one of degree; because natural

things which are scarce and esteemed will be counted as economic goods even if they do not happen to be brought to the market.

Though, from the viewpoint of utility, the term Natural Resources has no precise definition, it may be taken to denote all the inert substances, living organisms and effective combinations of physical forces, which men utilize as *bases* for the promotion of their material welfare. This limits the field of our study to basic materials and forces which are processed to fulfil the conditions of utility and exchangability. Since Natural Resources are here discussed in their sociological and material aspects, many aspects of the environment which are not the source of these primary products will have to be excluded. Soil, for instance, is a Natural Resource, because of its ability to produce plants, but we shall concern ourselves mainly with such plants as form the basic resource for serving certain demands. Similarly, water is another of the great Natural Resources, since it is an essential to the life of both plants and animals. But we shall include water only as a product for direct consumption, or the products derived from water-bodies and used as basic materials. The atmosphere is also a Natural Resource, but it is everywhere present and freely available to all, and therefore excluded from our study. Most of the energy-imparting resources have their origin in the radiant energy of the sun. We are concerned not with the sun, but the material aspects of animal and vegetable life resulting from the energy input of sunlight. Similarly, the energy content of coal is ultimately derived from sunlight, but coal is a basic Natural Resource of energy for serving human wants. If we take into account the proportion and accessibility of useful substances in basic resources offered by

nature, we have to extend the list further. From the standpoint of utility, what interests us most about metallic ores, is the proportion of metal they contain. If, for instance, we speak of the satisfaction of the demand for rubber, we lay stress not only on the Natural Resources (rubber-yielding trees) but also on all basic substances out of which synthetic rubber may be produced. Moreover, where a material in its natural state is a compound of widely differing useful substances, e. g. *galena ores*, containing lead, zinc and silver, it is generally necessary, first of all, to process it in order to separate the ingredients. Its compound character is, therefore, not generally a source of ambiguity in the classification of Natural Resources, because we simply use the basic materials resulting from the splitting up of the compound.

Things seem to be rather chaotic, what with so many criteria of resource classification, so many hierarchies of values in consumption. We may approach our problem, either from a purely geographical standpoint, and lay stress on the original elements of nature, i. e. sunshine, water, soil, minerals, natural vegetation and animal life, rather than on the basic products derived from them; or from the sociological point of view, and consider the basic products themselves, obtained from the physical environment, as the bases of existing consumption in quantity and kind. The latter view seems less arbitrary and more hopeful. It seeks to evaluate the Physical Forces from the Human Focus. The socio-economic values of the Physical Forces tend to be reflected by Natural Resources, which are essentially the products of primary industries, i. e. the want-satisfying goods and services obtained as the result of the application of initial human effort. It is upon this basis that we shall, in fact, classify

Natural Resources.

The main groups of Natural Resources may be classified into Food-stuffs, Raw-materials and Power. The Basic Food Resources are sub-divided into (1) Primary, and (2) Supplementary; the Basic Raw-Material Resources into (1) Metals and Minerals, and (2) Organic Raw-Materials; and the Power Resources into (1) Animate and (2) Inanimate. In comparing the Economic Strength of peoples in two regions, we shall have to consider a well circumscribed group of articles representing a complete *Resource System*. For the sake of convenience, and in keeping with the objective of our study, we shall classify Natural Resources into four distinct patterns, viz. *Food-stuffs, Metals and Minerals, Power, and Organic Raw-materials*.

Food-stuffs are the most vital resources for the existence of mankind. These are derived mainly from vegetable and animal resources. Since their distribution depends on soil and climate, each region exhibits a distinct food resource pattern. In the development of economic life, not only the quantity and quality, but variety and continuity are also important. The closest approach to a general world opinion as to what should constitute the primary or supplementary foods, may probably be found in regional standards of consumption. The primary food materials, vital for existence may, however, be grouped into cereals, pulses, oilseeds, milk, meat, fish, sugar, spices, fruits, vegetables, etc.; whilst the supplementary or non-essential food materials, consumed generally to promote a comfortable or luxurious standard of living, might include eggs, poultry, tea, coffee, cocoa, honey, certain fruits and vegetables, etc. Water also constitutes a vital food resource. The importance of water as a factor in geographical environment is

at once evident when we reflect that, along with air and sunlight, it is one of the predominant Natural Resources that make life possible. Water is even more important to man than food, his existence probably would end somewhat abruptly if water-supply were cut off than if he were deprived of food. Man's food, moreover, consists chiefly of plants and animals, and neither of these forms of life can continue without water.

The Natural Resources in minerals may be classified under three groups, viz. *Organic*, *Metallic*, and *Non-metallic* minerals. The Organic minerals are peat, coal, petroleum, etc. From Metallic mineral ores are derived (1) Basic Metals, e. g. iron, manganese, chromium, tungsten, gold, lead, zinc, silver, copper, etc., (2) Subsidiary Metals, e. g. nickel, cobalt, vanadium, mercury, antimony, aluminium etc. The Non-Metallic minerals may be grouped into (a) Chemicals, e. g. borax, arsenic, sulphur, salt, saltpetre, etc., (b) Building Materials, e. g. limestone, sands and clays, sandstone, other stones, etc., (c) Miscellaneous Raw-material minerals, e. g. mica, asbestos, asphalt, monazite, magnesite, graphite, barytes, precious stones, etc. This list is by no means exhaustive, neither is the classification in order of economic importance. The economic importance of a mineral will depend on the purpose for which it is required, and certainly on the progress of scientific knowledge which will unfold ever newer uses of minerals for the development of material culture. Almost all known categories of minerals in the world (about 1,500 species) are utilized for various purposes, but it is the occurrence of certain workable combinations in close proximity, e. g. coal and iron; limestone, gypsum, and clays; or groups of chemicals, that determine the possibility of in-

dustrial development and the pace of economic progress. Since the beginning of the twentieth century, the outstanding factor in the progress of modern industrial civilization has been the wide and increasing utilization of many 'new' mineral substances that formerly were regarded almost as scientific curiosities.

The Natural Power (or Energy) Resources include not only mineral fuels, e. g. coal, peat, petroleum and natural gas, but moving-water, wood-fuel, wind-force, animal and human energy potential. Though coal and water are the main sources of power, petroleum (specially in the form of gasoline) ranks the highest. Both coal and petroleum are wasting resources, therefore, in the future the use of water-power will probably increase rapidly. The supply of water power is in no danger of exhaustion. In many regions, wood is the principal source of power, and utilized for domestic and industrial purposes. The exploitation and utilization of wood-power resources depend both on the quantity and quality of floral forms. Wind power is an old and useful source of power, which is still utilized in certain regions for small scale industrial enterprise. The utilization of wind-power, both on land and on sea, has its own limitations; whilst the utilization of solar heat, as a source of industrial power, is still in an experimental stage. Horses, cattle, camels, elephants and other draft animals are still employed for the purposes of transportation, whilst the services of horses and oxen are indispensable for the cultivation of land, rural transport, and irrigation in many agricultural countries of the world. But, probably the most important power resource is Human Energy. It is applied in the utilization of both animate and inanimate forms of power, and upon its quantity

(*number*, indicating capacity), and quality (*fitness*, indicating ability), depend the degree of resource manipulation and the pace of economic progress.

The range and variety of basic raw materials, drawn from vegetable and animal resources, are indeed very great. The organic substances include timber, fibres (cotton, jute, hemp, flax, sisal, wool, silk, etc.), hides and skins, fodder, oilseeds, tobacco, coconuts, lac, bees-wax, herbs and drugs, gums and resins, dyeing and tanning substances (roots, barks, pods, berries, flowers), guts and casings, hair and bristles, etc. Certain substances are also provided by marine flora and fauna (e. g. sponge, pearl, shell, non-edible fishes, etc.). Of these, and many more, only a few are important raw materials at certain times and in certain types of society. As the economic system changes, the list of basic raw materials is transformed, and materials which had been merely uninteresting or even undesirable, become important bases of industry.

From the viewpoint of the economic ways of producing want-satisfying goods and services, Natural Resources are the original products mainly of *Primary Industries*, and include such services as are employed in this elementary act of production. The Primary Industries include: (1) *extractive* industries, e. g. fishing, lumbering, mining and tapping of minor forest products, where man collects products directly from nature; (2) *genetic* industries, e. g. stock-raising, plantation, agriculture, where man brings about the production of foodstuffs and raw materials by getting the environment (soil, climate, and water bodies) to help him to "raise" or "grow" them; (3) *power* industries, e. g. the harnessing of moving water, solar-power, wind-force, animal and human energy, where man controls the forces of nature and utilizes them as aids to production.

The environmental relationships of all basic goods and services, viz. foodstuffs, metals and minerals, power (including human energy), and organic raw materials, produced by Primary Industries, are immediate and direct. But the Secondary Industries (e. g. manufacturing) which take for their raw material the products of Primary Industries, and make them more valuable by adding to them either form, time or place utility, cannot be said to produce Natural Resources.

3

FOUNDATIONS OF NATURAL RESOURCE POTENTIAL

The basic concept of Natural Resources is embodied in the physical environment. The relationship between the physical environment and Natural Resources, on the one hand, and between potential resources and human activity, on the other, can be understood only when earth is considered the mother and home of man. The underlying idea is, that the earth is a grand stage upon which mankind is playing the drama of its social history. It furnishes numerous hidden as well as obvious resources which constitute the apparatus for human survival and progress, and the degree to which man can adapt to its possibilities depends on his ability to manipulate the materials and forces in relation to space and time.

The physico-environmental factors, which determine the quantity and kind of Natural Resources, are: *locational* (situation, shape, size, distance, proximity, isolation); *physiographical* (structure, relief, minerals, soil, water-forms); *climatic* (composition of atmosphere, temperature, pressure, winds, rainfall, humidity, variability, and other aspects); *biological* (plants and animals); *social* (man and his works). Each of these factors is an important portion of the world-stage, and

in its relation to every other portion forms a unity. The combined influence of these factors determines the resource pattern—both organic and inorganic—and conditions the mode of life of the inhabitants in a given habitat. Environmental differences in their final analysis tend more and more to become the basis of a geographical division of labour, and the Economic Strength of a people in terms of Natural Resources, indicates the form, manner, and extent of utilizing the environment.

The location of a region implies not merely its situation on the globe, but also size, shape, accessibility and proximity in certain spatial relation to other elements of the environment. Frequently, location indicates the nature of other environmental factors, and profoundly influences the character of human activities. A favourable location enhances the place utility of Natural Resources of a portion of the earth's surface, large or small. The iron and coal resources of Bengal, for example, are found in close proximity, hence their place utility for smelting purpose. On the other hand, some of the high class iron ores localized in Hyderabad and Madras cannot be fully utilized in the absence of metallurgical coal. Had the iron deposits of these areas, and the manganese deposits of the Central Provinces, been around the coal-fields of Bihar or Bengal, their value or usefulness would have been many times greater. Likewise, the location of agricultural land near sources of water-supply, of mineral and organic raw materials near industrial zones, or of food materials near large (urban) consuming centres, confers upon these resources newer and greater values. The water-power resources of the Western Ghats owe their development and impor-

tance to location near industrial areas, whereas the vast hydel resources of the Himalayas still remain undeveloped and unused. The value of crop-land near large cities is higher than that in remote rural areas, so are differences in the value of crops raised in the proximity of markets or remote from them. Thus the importance and utility of resources depend largely on location, i.e. nearness or remoteness from the point of consumption, accessibility and degree of response to effort, and the occurrence of certain desired resource-combinations in close proximity.

The influence of location on Natural Resources is either direct or indirect. The direct influence is exercised through such factors as latitude, altitude, geological structure, relief, prevailing winds, proximity to large water-bodies, and largely noticeable in the case of soils, minerals, water-forms, sub-soil water reservoir, water-power, etc. The indirect influence is exercised largely through climatic factors, i.e. temperature, pressure, winds, rainfall, humidity and variability, and tends to affect plant and animal life—the type of natural vegetation, the distribution of life on land and in water, the range of plantation and agricultural crops, and above all the energy potential of the human factor.

Since location is an absolute factor of the physical environment, man cannot alter or greatly modify it, and has often to submit to its possibilities. It is, therefore, a limiting factor in determining the resource strength of a region. If a people are isolated in a closed region, such as the Sahara, they can scarcely pursue the maritime interests of the adventurous British, or the noble activity of the peaceful Ganges-valley farmers. Moreover, the accessibility of a region determines

the degree of human contentment, as is amply illustrated by the stereotyped and moribund mode of life in the Congo and Amazon basins, or the peripatetic and enterprising behaviour of the peoples of Baluchistan or Chinese Turkestan. This also explains to a large extent why the peoples of India and China have remained agriculturists for many long centuries, while the peoples of Great Britain and Japan became industrialists in a few decades.

As a relative factor, however, location stands in a certain relationship with its immediate neighbourhood and the rest of the globe in space and time; and indicates the natural advantages emanating from the peripheral position of a region—e.g. India holds a central position in the Eastern Hemisphere, and dominates trade routes between the West and the Far East, whereas New Zealand is distinctly handicapped in its national economy owing largely to a poor peripheral position.

The utilization of Natural Resources depends much on natural advantages emanating from location, e. g. *distance*, a factor in transportation; *shape*, i. e. coastal indentation, determining harbour facilities and possibilities of commerce; *isolation*, i. e. intra-continental or extra-continental situation as a factor in progress; *sphere*, i. e. zonal distribution of a region in the tropical, temperate or polar belt; *density*, i. e. population pressure, as an active factor in resource manipulation. Judged from these criteria of resource distribution and utilization, sharp contrasts become at once noticeable between such countries as Siberia and Germany, North America and South America, India and Japan. Asiatic Russia, with its vast area and abundance of resources in men and materials, has suffered retardation in progress because of her

position on the outskirts of Asia, remote from its great centres of development. The intra-continental position of Germany, with limited resources but energetic labour, is responsible not only for the fullest mobilization of her potential resources, but also for the militant technique of adaptation due to a rapidly growing population and depleting resources. The strategic position of the East or the West Indies would maintain the importance of their resources, while the natural disadvantages of Alaska tend to outweigh the force of her resource-potential. But the most important aspect of location is reflected by the zones of human concentration, e. g. sub-tropical, warm-temperate and cool-temperate regions, because the utility of resources depends on the degree of applied effort, and the magnitude of produced effect, facilitated by energetic and invigorating climates.

Next to the influence of location, on the distribution of Natural Resources, is the very marked one of topography. The most noteworthy differences in the amount, nature, and variety of resources are due to relief (that is, to hills and valleys, plains and plateaux, mountains and basins). The surface features of a region are indeed the reflection of its underlying geological structure. Differences due to relief are found in distance which facilitate or hamper transportation. Moreover, a relatively disproportionate appearance of physical features in a given region accounts for unbalanced distribution of Natural Resources. In a table, prepared by Huntington, of the world's chief products, "only three out of the seventeen food products are more abundant in mountains than in plains, namely, sheep, coffee and tea. Among the non-metallic raw materials only two, or at most three, out of six, i. e. wood

and wool, and perhaps, raw silk, came mainly from rugged regions; among the materials for fuel and power only water comes mainly from such regions, although coal is found partly in regions of moderate relief. Among the metals, however, all except iron come chiefly from regions of high relief, and even iron comes mostly from old worn-down mountains." In short, only six of the twenty-four resource products derived directly from plants and animals (*viz.* sheep, wool, wood, coffee, tea and silk), and at least six out of nine mineral products, are drawn from rugged regions. Though rugged regions abound in plant and animal resources, economically they are not much developed. Most of the basic resources which serve the needs of modern man, are derived from plains and uplands. This is so, because the thinness of soil, narrow climatic limits, and transportation difficulties are limiting factors of rugged relief.

Climate is by far the most important of all the factors of the physical environment. In the last analysis, climate comprises not only heat, moisture, and variability of temperature, but latitudinal and altitudinal location, proximity to neighbouring land masses and water-bodies, and other associative environmental factors. In large measure, climate determines where man shall live, and where the greatest human activities shall be performed. Those regions of the earth, which are under the blight of an unfriendly climate, have wisely been abandoned by man, because human adjustments are made only in benevolent climates.

Climatic changes over long periods tend to alter the face of regions, and stimulate the evolution of plant and animal life. This has far-reaching consequences on the distribution and utilization of Natural Resources, and ultimately on

human progress. Every change in climate alters the struggle for existence, and forces plants and animals (including man) to migrate or to modify their habits. If they do not, they perish. The evidence is ample that only the species capable of adapting themselves to a changing climate survive and progress.

There is causal and logical relationship between climate and Natural Resources. "Every plant and animal", says Huntington, "has what is called an optimum climate, that is, a certain temperature, humidity, variability, and degree of sunshine, under which it thrives." The climatic optima, i. e. climatic conditions most favourable for the normal development of plant and animal resources, explain why the tropics are plentifully clothed with forests, and the temperate prairies carpeted with grasses; why south-eastern Asia produces three-fourths of the world's rice crop, and North America the major share of the world's wheat and corn. It is an index, not only to the distribution of forest areas, grasslands, agricultural zones, fishing grounds and animal habitats, but to the possibilities of resource exploitation; and it enables us to judge whether the production of a given resource (i. e. food, mineral, power or raw material) can be stimulated or started. Each Climatic Zone, therefore, tends to become a typical Resource Zone, and man makes his best progress under those conditions which stimulate him to sustained effort.

The *climatic optima* of certain staple products derived from vegetable and animal resources deserve special mention. Wheat, for example, is grown mainly in a belt 20 degrees and 60 degrees N. and S. of the Equator, with mean annual temperature between 39 degrees and 68 degrees

Fahrenheit, and 20-40 inches rainfall (i. e. cool and moist climate). Rice has an optimum temperature between 75° and 90°F. and 60-100 inches rainfall (i. e. warm to hot-wet climate), and grows in a belt 40°N. and S. of the Equator. Cotton, with an optimum temperature between 68° and 87°F., and 20-40 inches of rainfall (i. e. warm to hot and moist to humid climate), is grown largely between latitudes 20° and 37°N. Similarly, the optimum for maize is a mean annual temperature between 55° and 83°F., and 40-80 inches rainfall (i. e. warm and moist atmosphere); for oats, between 28° and 68°F. and 20-40 inches rainfall (i. e. cool and humid conditions); for sugarcane, between 65° and 88°F. and 60-80 inches rainfall (i. e. warm to hot and wet to moist climate); for potatoes, between 35° and 61°F. and 20-60 inches rainfall (i. e. warm to cool-humid climate). Likewise, tea demands warm and wet uplands; coffee, hot and wet plateaux; coconut and bananas, hot and wet lowlands. "The rubber tree secretes its latex, and the rich cacao-bean and palm-nut their oil, only in the ceaseless heat and ample moisture of the tropics. All the spices are products of the tropics, and the date-palm, queen of the desert and chief food of oasis-dwellers, is so specialized in its habits that it must grow with its roots in water and its crown in cloudless sunshine."

The *climatic optima* of animals are not so evident as those of plants, but they are just as real and important. The camel loses its value when taken into wet tropics or snow covered Arctic lands. In the same way, sheep do not thrive in hot-wet lowlands. Horses and cattle thrive best where temperature is moderate, and the summer pasture and winter hay are abundant and nutritious.

Wherever great heat is coupled with humidity, the milk-yielding capacity of cattle, the quality of flesh, and the pelt of skin, deteriorate very considerably. Some of the best varieties of fowl are reared in cool and dry climates, and geese in warm and wet ones. A cool temperate climate is highly congenial to fur-bearing and wool-yielding animals, while warm temperate waters contain the world's chief edible and industrial fishes and other marine fauna.

Obviously, not all plant and animal resources are produced within their climatic limits, because departures from the optima are more than balanced by such economic factors as cheapness of land, cheap and abundant supply of labour, improved technique of production, low cost of transportation, nearness to markets, wider scope for competition with imported goods, etc. It pays the producer to raise certain products outside the climatic optimum, and benefit in a widely competitive system of price economy. Take cotton, for example. It is grown in Bengal outside its optimum, and therefore suffers from excessive moisture and low variability of temperature. For cocoon rearing, the climate of Peninsular India is probably warmer than the optimum in China. Oats are grown in Kashmir where the climate is decidedly warmer and drier than needed. This is more true of market gardening, fruit growing, poultry- and dairy-farming, which are not unoften localized outside their optima in the vicinity of large urban consuming centres. Nevertheless products thus raised suffer in quality and quantity of production, and the cost of production increases because of the application of artificial fertilizers, extra labour, the higher rent of land, and other aids to productive forces denied by nature.

• In the last analysis, climatic optima determine not only the absolute advantage of certain regions in the production of certain resources, but comparative advantage in the production of others; and it is on these bases of greater advantage and lesser disadvantage that inter-regional commerce is planned and carried on.

4

DISTRIBUTION OF NATURAL RESOURCE AREAS

There is a definite relationship between the physical environment and Natural Resources in different regions of the earth. Regional differences in the kind and quantity of resource potential are apparent from the facts that one region is mainly agricultural and another industrial, one small region produces a larger quantum of certain resources than another comparatively larger in size, certain varieties of products are raised in one region and different ones in another, or that one region may abound in mineral resources but lack food materials. There may also be found a wide diversity of occupations (due to varied stages of economic development) in one region, but a narrow range of occupational mobility in another. Finally, one region may contain a healthy, energetic and progressive population, while the other accomodate only physically debilitated, mentally handicapped or culturally backward groups of humanity. These regional differences are in large measure due to resource differences, and offer a clue to the measurement of a people's economic strength and social progress.

The fundamental concept underlying Resource Areas leads inevitably to, and limits its scope within, the confines of a *natural region*. This is so, because the term 'Natural Resources' has only a

relative significance. It implies the quantity and variety of wealth producing goods and services made available for the use of a certain people in a given habitat. That is, the functional reciprocity of man and his resources finds expression only in a well-defined Resource Area. Geographically, a *region* is a Resource Area on the earth's surface, which is essentially homogeneous in respect of the conditions affecting human life. The uniformity of geographical conditions bestow upon a *region* a distinct resource pattern, which ultimately moulds human conduct and determines economic strength. As a representative unit of the physical environment, a *region* becomes the true index to the magnitude, nature and variety of resource potential, and stands in a resource relationship with its immediate neighbourhood and with the rest of the globe.

Regional differences in resource strength are due to two factors, *first*, original differences in regard to natural resource potential, and *second*, other things being equal, the degree of resource response to human effort. The regions well endowed with Natural Resources might not indicate equal degree of strength and economic progress. Certain regions with meagre resources are thickly populated, but some highly resourceful areas abandoned as of no use to civilized man. There are pictures of settled village economy and prosperous life in one region, and sparse and shifting habitations of discontented groups of humanity in another. Cultural differences reflect to a large extent the characteristic advantages or limitations of Resources. A brief survey of the world's principal resource Areas is made in the following pages:—

(a) *Regions of Bounty* are characteristic of the Equatorial lowlands and plateaux, e. g. Malaya, the

larger part of the East Indian Islands, Ceylon, the coastal margins of south-western India, western Africa, parts of Amazon and Congo basins, and north-east South America. Here nature is bountiful, and man is the mere gatherer rather than the active producer of things he requires. A very heavy rainfall, uniformly high temperature, and high humidity, facilitate a vigorous growth of luxuriant vegetation and rapid multiplication of animal life. Whether in lowlands, or elevations, the struggle for existence is very severe, and human adaptation in the face of constant encroachments of plant and animal communities is more often frustrated and defeated. Unhealthy climate reduces human vitality to the minimum, and restricts economic and social progress of the inhabitants. Nevertheless, in view of the valuable resources in food and raw materials, e. g. timber, tea, coffee, sugarcane, rice, bananas, yam, pumpkin cassava, sisal, quinine, ivory, roots and barks, gums and resins, grasses, etc., the regions of bounty comprise the greatest reservoir of wealth, and make an overwhelming contribution to the world's business today. Certain notable features of the resource potential of these regions are: *first*, there is not only an immense variety of vegetable products, but a rapid growth of vegetation; *second*, the most important products are derived from forests and plantations, but agricultural and animal resources are not of much commercial importance; *third*, though the distribution of wild animals is large and varied, valuable domestic animals are scarce and poor in quality; *fourth*, due to very heavy rainfall and high temperature, the land is rapidly weathered and leached, hence the agricultural crops poor in quality, yield, and food value; *fifth*, in view of the prevalence of tropical

diseases and tropical weaknesses, difficulties of transport and availability of energetic and sustained labour, accessibility to potential resources is difficult and, therefore, full and regulated exploitation not possible; *sixth*, the distribution of minerals is, on the whole, poor, and mining operations are generally restricted due to excessive heat and humidity.

(b) *Regions of Increment* are very similar to Regions of Bounty. Both have hot climate and heavy precipitation. But the Regions of Increment receive seasonal rainfall, and are characterized by hot-wet summers and cool-dry winters. Such regions are the typical Monsoon lands of India, Burma, Indo-China, Southern China, incorporating also other lands of monsoonal effects, *e. g.* north-western Australia, the fringes of Africa facing and including Madagascar, the West Indies, Central America, the northern fringe of South America, and the eastern parts of Africa. A wide range of temperature and rainfall, coupled with marked seasonal changes, are the most favourable conditions for the growth of vegetation and animal life. Monsoon regions, therefore, abound in forests, plantations, and animal resources, and make agriculture the most successful and productive industry. There is a great diversity of Natural Resources. The application of effort in these regions results in a proportionately greater production of wealth, consequently, the density per square mile of population (particularly in fertile river-valleys and deltas) is perhaps the highest in the world. The main classes of Natural Resources are of vegetable and animal origin. Vegetable resources comprise timber and fuel-wood, minor forest products (*e. g.*, lac, gums and resins, dyeing and tanning substances, bees-wax and honey, herbs and drugs, grasses, etc.), planta-

tion wares (*e. g.* tea, coffee, rubber, cinchona, semul, banana, pineapple, sugarcane, coco-nut, areca-nut, palmyra, spices, etc.), agricultural crops (*e. g.* wheat, rice, maize, millets, pulses, oilseeds, cotton, jute, hemp, fodder, and tobacco, to name only the most important staple crops). The resources of domestic animals are: hides and skins, milk, flesh, wool, hair and bristles, dung for fuel and manure, and animal services for cultivation and transportation. The distribution of warm-water fishes, sub-tropical poultry, and other floral and faunal resources is indeed very great. The main features of the resource potential of the Regions of Increment are: *first*, the preponderance of vegetable resources, agriculture being the primary source both of food-stuffs and raw-materials, supplemented by forest and plantation products; *second*, the largest concentration of domestic animals whose services and products are indispensable for the existence of the inhabitants; *third*, the range of agricultural and forest products is unsurpassed by any other Resource Area of the world; *fourth*, the soil is well supplied with moisture and organic manure, and is generally capable of producing two or more crops; *fifth* due to marked seasonal variations, there is a great possibility of acclimatizing exotic varieties of crops and animal types; *sixth*, the distribution of minerals is fairly wide and substantial, and water-power resources in rugged relief ample for the industrial needs of the people; *seventh*, though human energy and efficiency fluctuate in harmony with the alternation of seasons, the people are of moderate health and energy, and by far the most progressive of the peoples of vegetable civilizations.

(c) *Regions of Effort* are found in the Temperate Zone, and divided into two distinct groups,

viz. (1) *cool temperate lands*, situated on the western margins of the continents, *e. g.* north-west Europe, north-west North America (excluding Alaska), south-west South America, Tasmania, and the South Island of New Zealand, and lands on the eastern margins with climate considerably modified by oceanic and monsoon influences, *e. g.* south-eastern Canada, north-eastern United States of America, northern Manchukuo, northern Japan, and south-east South America; (2) *warm temperate lands*, widely separated areas lying between latitudes 30° and 40° North or South (approx.), *e. g.* the lands bordering the Mediterranean Sea, central California, central Chile, the extreme south-west of Africa, the south-west of South Australia, the south-west of Eastern Australia, and the North Island of New Zealand. These lands on western margins of the cool Temperate Zone are characterized by temperate deciduous (hardwood) forests of oak, beech, elm, maple and birch. Wherever forests have made way for pasturing and agriculture, cereals, fruits, roots, fodder crops, hemp, and flax are raised; sheep are reared for wool and mutton, and cattle for beef, milk and hides. Lumbering, fishing, fruit-farming, cattle and sheep-rearing are the main industries. The lands on the eastern margins have agricultural and pastoral occupations similar to those of western marginal lands, and forests and fisheries constitute their most valuable resources. The forests are largely deciduous, but conifers (soft-woods) are fairly distributed. The climate of these cool temperate lands, on the whole, is most favourable to human activity. The people, therefore, tend to be virile and industrious, and the energy expended by them is amply rewarded. These regions have become essentially industrial, and together

they contribute the greater moiety of the total manufactured goods entering the world's commerce. The Mediterranean lands (warm temperate regions), on the other hand, characterized by hot-dry summers, and warm-wet winters, have a natural vegetation adapted to resist the drought and heat of summer, *e. g.* olive, oak walnut, chestnut, cork-oak, fir, cyprus, cedar, mulberry, and plants yielding resins, waxes and essential oils. Natural pastures are rare, and therefore cattle are not reared in large numbers. Hard varieties of wheat and barley are grown in large quantities, but rice cultivation is restricted to wetter areas. Cotton is grown where artificial aids to irrigation are available. Fruit resources are by far the most valuable, chief amongst which are the citrus fruits (orange, lemon, grapefruit), the grape, fig, olive, apricot, peach. Mulberry leaves are utilized for feeding silkworms, and cocoon-rearing is an important industry. But the peoples of the Mediterranean climate have to put forth less effort than the peoples of the cool temperate regions in order to gain a living from the Natural Resources. As a result, they are commercially less progressive, but they have devoted their imaginative minds to the development of such cultural traits as the arts and civil organization. On the whole, however, the Regions of Effort respond adequately to human effort, and man is rewarded generally in proportion to energy expended. Inhabited by healthy, energetic and enterprising races, such regions are the most developed economically, and their highly advanced material culture makes them essentially the spheres of industrial (machine) civilization. The characteristic features of the Regions of Effort, as a whole, are briefly: *first* agriculture is subservient to pasturing, fishing, lumbering or

fruit-farming; *second*, the basic food materials and raw materials are derived from animal (including fish and bird) resources; *third*, there is lack of vegetable food-stuffs, and raw-materials essential for manufacturing industries—that is, though fruits are grown abundantly, there is deficiency of cereals, oilseeds, cane-or beet-sugar, vegetable-fibres, spices, etc.; *fourth*, the climate favours the fullest and continuous exploitation of minerals, and the mining industry, wherever possible, is highly developed; *fifth*, both mineral fuels and water power are adequately distributed and utilized; *sixth*, the supply of energetic and efficient labour is largely responsible for a rapid and profitable development of Natural Resources; *seventh*, due to the scarcity of vegetable foods and raw materials (particularly cereals, stimulants, fibres and oilseeds) the peoples of these regions are animated by a tradition of commercial enterprise, and not unoften their greed, motivated by their needs, for these basic resources, compels them to employ an aggressive technique in dominating the peaceful peoples of vegetable civilizations.

(d) *Regions of Arrested Development* are those, where on account of adverse geographical conditions (particularly restrictive climates), man ekes out a bare subsistence even with the best effort applied. Here nature does not reward man in proportion to his effort, that is, there appears a lag between the degree of effort applied and the magnitude of effect produced. Economic progress is, therefore, slow and restricted. The necessity of developing such regions arises from the fact that a country has to support a fast-growing population. The Ricardian postulate, that under pressure of population less favourable lands are brought under cultivation, or new areas with

limited resources inhabited, is applicable particularly to older agricultural countries, such as, parts of India, China and Central Europe. As a rule, the most resourceful regions are first inhabited and developed, and the exploitation of comparatively less productive regions is a later phase in the development of economic life. The Regions of Arrested Development are so named because in them the limit of maxima exploitation is soon reached, and further application of effort gives a diminishing return or becomes entirely unproductive. Since these regions lie on the margin of productive exploitation, their occupation or abandonment is decided upon by fluctuations in population pressure. Wholesale migrations or high mortality (whether due to epidemic diseases, famines, or wars), sooner or later, result in their abandonment. The Regions of Arrested Development are found on the fringes of the Equatorial belt, the borderland of deserts, in cold temperate intra-continental areas, arid mountains and plateaux, and the swamps of tropical deltas. Roughly speaking, Finland, Scandinavia, Labrador Plateau, Alaska, parts of Siberia, Mongolia, Tibet, and the Savannah lands of Africa fall in this category. Although the application of science has enabled man to extend the cultivation of arid lands, to reclaim tropical forests and swamps, and to convert mountain-sides into valuable terraced fields, human ingenuity fails to control the all powerful geographical conditions, and the margin of economic gain is decidedly the least attractive. The main resource characteristics of these regions may be summarized here: *first*, there is a limited variety of natural vegetation, either in the form of large trees, scrub or grasses, according to climate and relief, therefore, vegetable resources

are, generally meagre. *Second*, agriculture is an unproductive enterprise, the main occupations being pasturing, meadow-husbandry and, wherever possible, lumbering and fishing. *Third*, the food materials of vegetable origin are coarse and scanty, e. g. barley, rye, millets, and potatoes, while vegetable raw-materials are wood and fibre. Animal resources are naturally adequate, but leave no exchangeable surplus in the form either of food-stuffs or of raw-materials. Fishing and lumbering are, however, comparatively more productive and their resources form the main items of trade. *Fourth*, as is natural and to be expected in rugged relief and dry atmosphere, minerals occur in large quantity and variety. Both metallic and non-metallic minerals, wherever accessible, are exploited profitably, and constitute the most valuable resources of these regions. *Fifth*, the water-power resources (particularly in regions of rugged relief and abundant rainfall) more than counter-balance the absence of mineral fuels, and their development, as in the case of Scandinavian and Alpine countries, has given rise to industrial enterprise. *Sixth*, the people, though hardy, are not progressive in comparison to the people of the Regions of Effort. Due to a limited supply of foodstuffs and raw materials, aggravated by difficulties of resource development, the economic development of these regions is hindered, and the people are contented with limited material welfare and a stagnant social organization.

(e) *Regions of Lasting Difficulty* are the cold and hot deserts (e. g. the Tundra, the Antarctica, the Sahara, the Kalhari, the Atacama, the Colorado, the Thar, a large part of Arabia, and the interior of western Australia), the Equatorial forest belt (5°N. and S. of the Equator), the

interior of the Amazon and Congo basins, parts of the East Indies and the lower Guinea Coast of west Africa. Here geographical forces tend constantly to overwhelm and defeat the activities of modern man. The struggle for existence is very severe, and the development of economic life is a pathetic story of great suffering and privation. At present the Regions of Lasting Difficulty are of little economic importance, except in areas where minerals are found, such as Yukon, which has gold supplies; the island of Spitzbergen, which yields coal; the Mackenzie Valley, where oil abounds, etc. Many regions, which are reclaimed after surmounting serious obstacles and developed under dire economic pressure, when the effort ceases, are soon engulfed by the mighty influence of surrounding forces. Therefore, permanent settlements and stable economic enterprise are not yet possible in such Resource Areas. The Natural Resources of all these regions are scanty and monotonous. In most cases the potential resources still lie unexplored, while in others, exploitation is hindered and often made impossible due to resistant climate. In the cold deserts, the land, permanently covered with masses of sheet-ice, is practically barren and supports no life: but the seas are extraordinarily rich, containing large supplies of fish (seals, walruses, whales, and edible fishes). Bird life is considerable, the principal bird being the penguin. Polar bear and polar foxes are well distributed. On the fringes, where land is freed from snow in the short summer, quick-growing vegetation (such as mosses, lichens, berry-bearing shrubs and bushes) supports herds of reindeer. The summer brings swarms of lemmings, foxes, hawks, gulls, goose, brant, swan, crane, loon and various species of duck. The

inhabitants are nomad hunters who depend largely on animal, fish and bird resources, which provide a precarious livelihood. The most valuable resources are skins and furs. In the hot deserts, total absence or great scarcity of rainfall, and a great range of temperature both between day and night and summer and winter, make vegetable and animal life precarious. Dry pastures support sheep, and camels are the only means of transportation. Where underground water wells up to the surface (oasis), palm trees flourish, and the inhabitants grow coarse wheat, barley, maize, millets, cotton, peas and beans, musk-melon, water-melon, and certain tuber vegetables. Unlike the cold deserts where all basic products are drawn from animal resources, the basic food-stuffs and raw materials in hot deserts are derived largely from vegetable resources. In the tropical forests and tropical lowlands, there is no dry season, and constant high temperature and heavy rainfall make the atmosphere particularly oppressive. On the fringes of the forests, agricultural clearings are found which are cultivated. Food-stuffs and a few simple raw materials are all derived from vegetable resources, and the inhabitants live in isolated groups in the collectional economic stage. The oppressive climate keeps the people stunted in growth and mentally arrested in development. The main features of the Regions of Lasting Difficulty are: *first*, scarcity and lack of diversity in Natural Resources, which give little contentment to the inhabitants; *second*, physical conditions constantly thwarting human control and making economic enterprise difficult; *third*, lack of sources of energy which, where available, cannot be fully accounted for, hence industrial development impossible; *fourth*; the surplus re-

sources (vegetable or animal) are not indispensable for human existence in other regions, which makes exchange less profitable; *fifth*, conditions of life in general repel colonizers from other regions and, therefore, there is little movement of population and dispersion of culture in consequence.

5

CONDITIONS OF RESOURCE ASSESSMENT

The assessment of Natural Resources is a preliminary condition for the purpose of estimating the economic strength of a people in a given region. But in view of the numerous technical difficulties, no assessment is possible with any mathematical exactitude. Difficulty lies not only in the quantitative measurement of resources lying scattered often in inaccessible areas, but in the translation into concrete terms of non-material factors and forces. Only a rough idea, therefore, can be acquired by scientific prospecting and a systematic survey of existing potential resources in a region. For the guidance of the investigator, however, certain broad principles for determining resource strength can be laid down:—

(a) *Category of Region*: The location of a region in a definite climatic zone is an index to the nature and variety of Natural Resources. There are rather marked differences in the quantity of resource potential in one region lying in the tropics and another in the temperate zone. Take Ceylon and Iceland, for example. The former, being a Region of Bounty, abounds in a variety of resources; the latter, being a Region of Lasting Difficulty, suffers from paucity and narrow range of resources. The diversity of climate, soil and topography in the Indian Penin-

sula admits of almost all varieties of resources characteristic of tropical and temperate zones, but the uniformity of climatic conditions in the Arabian peninsula is responsible for its poverty even in the primary gifts of nature. The sharper the contrast in land-forms, range of temperature and rainfall, and seasonal variations, the greater is the likelihood of diversity in resource potential.

(b) *Dimension of Resource Area:* The size of a region reflects in a large measure the quantitative aspect of Natural Resources. As a rule, the larger the area of a region, other things being equal, the greater is its capacity and strength in resource potential. Consider, for instance, the Resource Areas of Belgium and the U. S. S. R., Mexico and the U. S. A., or Ceylon and India, which clearly indicate the natural advantages of a large area over those of a smaller one. In a large Resource Area, such as we have in India, the U.S.A. or the U.S.S.R., a greater variety of climates makes possible a more varied and larger quantity of resources. But wherever climatic conditions are more or less stable and monotonous, such as we find in Siberia, the Antarctica, the Sahara or the Amazon Basin, the quantity of resources may be meagre, and the range and variety narrowed and limited. It is, therefore, the combined influence of climate and relief on the size of Resource Areas that ultimately determines the resource potential.

(c) *Size of Population:* Human resources constitute the most important element of Natural Resources. In estimating a country's resource strength, therefore, the numerical criterion of population becomes at once evident. The size of population determines the quantity of production

and consumption, surplus or deficit, and the degree of progress. A large and growing population affords greater opportunities for the development of Natural Resources. The resources of a region in terms of human population depend on several factors, such as the existing number, birth-rate, health, and longevity. In the final analysis, it is not the total population but the number of effective workers engaged in the production of utilities from the environment. Other things being equal, the larger the number of effective workers, the greater the production of wealth. Thus the resource output of two regions, equal in area and with similar climates, but containing unequal number of effective producers, will vary in proportion to the size of population. If, however, a country has a large population composed of a proportionately greater number of old and invalid, or of people seeking more liesure, it will indicate a tendency to increased consumption than production, and here, instead of surpluses we may expect deficits of resources.

(d) *Stability and Variability in Production:* Economic analysis of resource assessment centres upon the variability of magnitude of wealth under varying conditions of production. In the normal economy of resource exploitation, various resources are conceived as being engaged with a certain rhythmic regularity of output in a given slice of time or successive slices of time. In stationery conditions a country's resources would produce every year about that magnitude of goods and services the whole of which would normally be consumed. In progressive conditions a portion of the goods and services thus produced takes the form every year of some addition to, the capital

equipment, making possible the production of a larger amount of wealth in the future. In stationery and progressive conditions alike, a country's resources would not be worked at the maximum imaginable intensity because changes in the direction of demand, normal requirements of leisure, and productive forces continually call for readjustments in the machinery of production. The variability of productive forces, *viz.* soil, labour, etc., tends in some measure to throw planned and regular production out of gear, and in any scheme of resource assessment these factors cannot be entirely overlooked. Climate is a fairly stable factor, but the range of probable variations, such as, the cyclic appearance of wet and drought years, frost and storms, temperature and pressure abnormalities, often disrupts the rhythm of production. Soil too, as a result of centuries of ruthless exploitation, fails to maintain a regulated pace of yield, while artificial aids to poorer soils in the form of ploughing and manuring, rotation of crops and irrigation, may bring about unexpected results. In many cases improvement in the technique of production, breeding of new species of plants and animals, diversion of land utilization from pasturing to cultivation, and additions to productive power in the form of labour and capital—all augment production. On the other hand, reduced personal consumption, cessation of exports, reduced investment or depletion of existing capital, increased enjoyment of leisure—all tend to slacken production. But the most variable factor in resource production is human labour. It varies both in quantity and quality, in peace and war, in famine and prosperity, in times of natural and social catastrophe. The range of such variations in productive forces and

relations of production, whether probable or unexpected, cannot always be known by experience, and therefore, due allowance for them must be made in any scheme of resource assessment.

(e) *Range and Substitutability of Resources:* The relative importance of resource patterns also deserves consideration. In any scheme of assessment, variety of resource patterns, range of resource types in the same pattern, and substitutability of one resource type for another, emerge important. Not all basic resources essential for economic existence and social advancement of the modern man are available in any one region. Therefore, regional exchange of surpluses (intentionally created by specialization in the production of those resources in which a region enjoys comparative advantage), or production of near substitutes, gives a certain degree of economic sufficiency to all the countries of the world. Differences in resource strength, however, are found in the possession of variety of resource patterns, *viz.* food-stuffs, minerals, power, organic raw-materials. A country may have an abundance and variety of food-stuffs but no minerals, another, raw-materials but no power, a third may possess all resource patterns, while a fourth may have only few of them all. Moreover, certain basic products in a region, for example, food materials, power and raw-materials, may be derived mainly from animal resources, or entirely from agriculture, or proportionately from both. There are then differences in the range of resource types *e. g.* food-stuffs derived from fishery and hunting, forestry and plantation, animal husbandry and agriculture. The range is also evident from certain patent combinations of resource types. For example, food combinations are wheat and meat

rice and fish, rye and potato, millets and pulses. Obviously, a wheat-milk-meat combination is more valuable than millets-vegetables-pulses; or rice-fish-vegetable oil than rye-potato-animal fat. Similarly, a coal and iron combination is far more useful than limestone and sandstone, cattle and horses than sheep and goats. These have to be judged from the viewpoint of world opinion, and international commercial values. Resource substitution also determines the degree of economic self-sufficiency as one of the criteria of economic strength. Demand for certain resources not found within a region may be satisfied by completely or approximately substitutable products. For example, in Russia flax has been substituted for Indian jute, in Poland rye for sorghum, in India brinesalt for rocksalt, in Scandinavia water-power for coal-power, in France animal-fat for vegetable-oil. A region with wider range of substitutability of resources must possess a greater economic strength than one with a limited range. Thus in assessing the comparative resource strength of countries, the criteria of variety, range, and substitutability must be applied from the standpoint of international commercial values.

(f) *The Character of the People:* In the assessment of resource strength, the qualitative aspect of human population is more important than the mere quantitative or numerical. This is so, because, the reasons why the meagre and limited resources of some regions are fully exploited, while the rich and abundant resources of others lie undeveloped, are illustrated by differences in the capacity and ability of the people for sustained production. Capacity to produce depends on the existence of potential resources and the numerical strength of population. Ability to produce

depends on racial and cultural qualities, *e.g.* inheritance, health and energy, training and equipment, and social environment. Inheritance determines the kind of abilities which a people possess, health and energy determine how far these abilities can be effectively employed, training and equipment (tools and instruments of production) determine in what direction the abilities are most productively applied, and finally, social environment determines the nature and degree of social control imposed on the utilization of 'ability' for the welfare of the society as a whole. Since productivity is synonymous with ability, and ability with cultural progress, the degree of resource mobilization should be measured in the light of those physical and social factors that mould the pattern of productive ability. The quantum of resource production depends also on the magnitude of demand. For instance, in all tropical lands people demand less clothing, a smaller quantity of mainly lighter foods, and a cheaper and simpler shelter than required by people of temperate lands. Again, the people of lower cultures need a smaller number and variety of commodities to satisfy their limited and simple wants, but the people of advanced civilizations require varied and many goods and services to serve their numerous, complex and growing wants in respect of food, clothing, shelter, transportation, recreation, instruments of production, and articles of comfort, luxury, and vanity. In the first place, the will to produce is weakened by a contentment characteristic of tropical climates (Regions of Bounty), or strengthened by the desire to cope successfully with a wider range of wants characteristic of temperate climates (Regions of Effort). In the second place, there is restraint on production in lower cultures due to primitive

instruments of production, while in high civilizations production is accelerated by better instruments and relations of production. However, in tropical regions due to the enervating climate, which keeps energy and efficiency at a low ebb, people's ability is poor and inferior, whereas the invigorating climate of the temperate regions imparts that quality of energy which is necessary to acquire superior ability. It follows that the people of tropical regions possess inferior ability in comparison to those of temperate regions, consequently the mobilized and effective strength of the former in Natural Resources must necessarily be lower than that of the latter. Thus the ability of people in a region is an index to the quantum of Mobilized Natural Resources.

6

THE HIERARCHY OF RESOURCE MANIPULATION

Though himself constituting part and parcel of Natural Resources, man is an active agent of his environment. His progress in any region depends on his ability to control the forces of nature for his material welfare. This functional interpretation, which stresses man's active participation in the determination of resources, is not a denial of his dependence on nature. As in primitive society, where man faced nature empty-handed without artificial aids, so in modern society, where man has developed the arts and sciences, and accumulated a multitudinous variety of cultural tools and apparatus for manipulating the environment, the significance of original nature in human life and progress is gravely important. However, the development of cultural superstructure, stacked tier upon tier on the foundations of nature, lessens the impact of environment on men and diverts the forces of nature into new channels. The cultural apparatus, by giving new meanings to nature, and by multiplying the points of contact between man and his physical milieu, enlarges the significance of nature, both in space and time. Basically, human life to-day is dependent on Natural Resources as it was in the beginning of human history, and there are definite limits on the ability of man to emancipate himself

from the limitations of nature.

The history of manipulation and social utilization of Natural Resources is roughly divided into three stages, *viz. etiological*, which is marked by man's utter dependence on the bounties of nature; *ecological*, characterized by man's reciprocal and balanced adaptation to his surrounding environment; and *epharmological*, which is based on the rational behaviour of man in an effort to dominate, control, and modify certain aspects of nature according to intention. The evolution of these hierarchies of resource manipulation is on convergent lines with the bio-social evolution of man.

In the first stage, the pioneer is an isolated creature of his environment. His chief reliance is on such resources as can easily be collected from the immediate neighbourhood. He, therefore, submits to nature's dictation with unquestioning obedience. In the absence of artificial equipment, the pioneer wastefully exploits the few aspects of nature which appear as resources, and destroys the many which appear as resistant or not immediately useful. So long as the goods of his requirement are easily available in one locality he stays, then he moves out. This state of collectional economy hampers the organization of stable settlements, and the organic and functional inter-relations of Natural Resources are obviously neglected.

In the second stage, however, man is equipped with tools which enable him to obtain returns both more bounteous in amount and varied in kind. Not only does man learn to satisfy his growing wants from a wider field and a broader range of resources, but by discriminately exploiting them he minimizes waste. Thus through the conservation of labour and resources is systematically evolved a permanent economy, which makes

possible the support of a larger population. With every growth of population promoting an expansion and refinement of demands, there is not only an intensive exploitation of Natural Resources, but a widening of resource-utilities in regard to those aspects of environment which were hitherto wasted or neglected. These changes in the exploitation and utilization of resources are brought about by mechanical technique of protection and a more stable organization for the co-operative conquest of nature. But the outstanding feature of this stage is a balanced economy where man and region maintain a reciprocal and harmonious relation. Man's mastery of his environment consists not in a one-sided exploitation but in a mutual bargain which alone keeps alive the never-ending cycle of the region's life-processes. This balance between the natural and the vegetable and animal environments (including the human) is of great significance in a discriminate exploitation of resources, because wherever man in the process of active adaptation has disturbed this ecological balance, *Nature* has frowned upon him and brought about destruction and ruin. In many regions long continued human actions such as brand tillage, denudation of forest lands, indiscriminate stock-grazing, interference with natural drainage, non-conservative agriculture, and ruthless extermination of animals, have altered the condition of the environment to such an extent that a large number of plants and animals fail to survive this onslaught. Whether in Regions of Bounty or of Effort, indiscriminate exploitation of Natural Resources results in the occurrence of periodical disasters such as malnutrition, epidemics and famines, scarcity of raw-materials and the consequent dislocation of in-

dustries, and not unoften forced wholesale migrations. Human progress in this stage, therefore, is largely a reciprocal and sympathetic adaptation to Natural Resource Environment.

The third stage is a mature stage of development, both in respect of effort and effect. Human effort is not only applied to the specific tasks of production, but directed more and more to the modification and permanent improvement of natural landscape, *e. g.* the construction of irrigation canals, the carving out of terraced fields, the tapping of sub-soil water, the extraction of minerals, the reclamation of marshes and swamps, the afforestation of arid lands and re-afforestation of exploited areas, the harnessing of moving water and atmospheric forces, the prevention of surface-soil erosion by embankments, the conservation of soil fertility by artificial manuring, etc. In other words, man's entire outlook towards nature has changed from utter dependence to one of domination and dictation. He has been able to defy the absolute environmental control of natural forces, and made two blades of grass grow where one grew before and two quarts of milk flow where one flowed before. He has also made resistant areas habitable, and by acclimatization made available a continuous supply of plant and animal resources outside their climatic optima. The transformation of natural landscape in this stage, with a view to increasing the magnitude and utilization of resources, is characterized by an increased use of advanced scientific knowledge and the increasingly dominant application of machinery. Supported with new and refined forms of energy, man can spread out, roam farther, and subject wider areas and deeper strata of earth to simultaneous and co-ordinated exploitation.

Out of the maze of forces which bring about gradual shifts in the stages of resource manipulation, (*i. e.* changes in population pressure, cultural equipment, including development of the arts and sciences, tools and machinery, etc., availability of energy, and the utilization of various aspects of the external environment)—the *energy* factor emerges as of supreme importance. Unlike other organisms, man appropriates 'foreign' energies for purposes of work, and without their aid he can never transform natural landscape into cultural landscape. The energies thus utilized are either animate (muscular) or inanimate (mechanical). The shift from almost exclusive reliance on animate energy to widespread use of inanimate energy (particularly since the Industrial Revolution) makes a major change in the energy basis of modern civilization, and a decided turning-point in resource utilization. The invention of the steam engine and mechanical power have revolutionized the processes of production, and radically altered the criteria of resource power. Organic energy is no longer the strategic resource and the major form of wealth, its place has been taken by coal, petroleum, water and other forms of power. The triumph of inanimate energy over animate, of mechanism over organism, and of dead force over living power, has promoted a new methodology and technique of resource exploitation.

In the hierarchy of resource civilizations, *viz.* *vegetable* (agriculture, animal husbandry, plantation), and *machine* (mining, commercial-farming, manufacturing), is reflected, in a large degree, the attitude of nations towards the possession and utilization of Natural Resources. Before the Industrial Revolution, the exploitation of land-surface (soil) was the occupation of an overwhelm-

ing majority of all peoples. It was, therefore, regarded as the major form of wealth, and its possession the chief criterion of prosperity. But food and clothing were universally derived from vegetable or animal products. Only minerals found near the surface were widely used. All economic activities (craftsmanship, commerce, finance) were supplementary to and dependent on the primary and genetic activities of soil exploitation, and all classes in society (landlords, workers, warriors, and communal functionaries) were supported by the tillers of soil. Land was the centre of all cardinal industries, while plantation industries occupied a peripheral position. In the post-Industrial Revolution period, however, land (in the sense of surface) ceased to be the major and strategic resource. The cardinal industries, representing a complex combination of power metallurgy, transport and manufacturing industries, constituted the central zone. Agriculture was thrust into a peripheral zone, dominated by the central (secondary industries) zone. Plantations still occupied the intermediate zone—the perennial nature of such products as rubber, coffee, cocoa, camphor, and quinine, resembling in many respects the modern overhead manufacturing industry.

The outstanding feature of resource utilization in modern machine civilizations is the greater exploitation and utilization of metals and minerals. Metals are indispensable for the manufacture of tools, machines and other apparatus for harnessing and supplying inanimate energy. A country richly endowed with mineral resources for power-driven machinery can build up an economy indefinitely superior in a material sense to the economy of a vegetable civilization dependent

entirely on animate energy. Inanimate energy, derived from such minerals as coal and petroleum, can be concentrated in quantities far in excess of any energy display which vegetable civilizations are capable. It can be speeded up more and sustained longer. Greater energies help to make better and stronger materials with which to harness still greater energies, and man can be relieved of much of the drudgery and monotony of manual labour. Largely because of the mineral resource pattern, the people who happen to possess a workable combination of coal and iron rise to a position of world domination—economically, politically, culturally.

7

NATURAL RESOURCES AND ECONOMIC RELATIONSHIPS

In the interpretation of economic function, the significance of Natural Resources is of paramount importance. Since economic life develops in harmony with the conditions of physical environment, it finds its limitations in the resources made available for transformation by human effort into desired things. In the process of want-satisfaction, economic activities are motivated and stimulated by resource patterns, because the nature and intensity of economic wants are a people's reaction to environmental stimuli. Thus, in all fields of economic life, the behaviour pattern of a people is merely a reflection of the resource patterns, and economic progress must be gauged from the degree of resource manipulation and utilization in a given habitat.

A functional anatomy of economic life reveals that human society in the process of active adaptation, passes through various stages of economic activity, *viz.* Collectional, Pastoral, Agricultural, and Industrial. Each of these stages is a landmark in the utilization of Natural Resources, *i. e.* the accumulation of wealth, the degree of comfort, and the development of material culture. Transition from one stage to another is facilitated or hindered by the nature and variety of resources. Since the

concept of Natural Resources is one of constant flux and changes, transitions in economic stages should be considered only as interrupted processes of adaptation. Things do not develop by means of slow, continuous changes, by means of an increase, a quantitative growth of certain resources and a qualitative perfection of technique of manipulation. But there are evolutionary *leaps* whereby certain stages may be skipped over. Though *leaps* do not indicate an absolute separation of the new from the old, they distinguish the mechanical and basic qualities of economic function between the pre-leap stage and the stage leaped into. A *leap* is almost always an indicator of hyper-interrupted development of an economic process, and is the result either of an infinite number of qualitatively definite changes in certain aspects of resource pattern or of infinitely subordinated changes in quantitative aspects of potential resources. The people of a region might, therefore, pass from the Collectional stage into the Agricultural (by skipping over the Pastoral stage), as is evident from the history of peoples in tropical lowlands and deltas; or from the Pastoral into Industrial (by skipping over the Agricultural stage), as is true of the communities in rugged regions of the temperate zone. The determining factors of all these transitions and *leaps* in economic progress are the range and elasticity of resource patterns.

The history of the development of society is above all the history of the manipulation of Natural Resources. *i. e.* the history of the modes of production of material values (*e. g.* food, clothing, houses, fuel etc.), which succeed each other in the course of centuries; the history of the development of productive forces (*e. g.* the bases and instruments of production including production

experience and labour skill) wherewith material values are produced, and which signify the relations of men to objects and forces of nature; and the history of people's relations of production (*i. e.* relations of men to one another in the process of production). Since economic life never stays at one point for a long time and is always in a state of change and development, at different stages of development people make use of different modes of production and apply different instruments of production. Moreover, productive forces are the most mobile and revolutionary elements of production, therefore, a change in modes of production is often forced upon a society and a new cultural pattern evolved. But whenever a change in modes of production, due to cultural change, seeks a change in productive forces, adjustment becomes difficult, and economic effort is often thwarted and impeded in the face of unproportionate response of environmental factors. Pressed to logical conclusion, the economic development of a people must be considered the result of resource manipulation, and since resource patterns are a creation of physical environment, the changes in the modes of production and instruments of production must take shape in harmony with the characteristic resource patterns of a region.

All contradictions between modes of production and productive forces are the inevitable consequences of disruptions in resource equilibria. There is an equilibrium between economic function and resource pattern on the one hand, and resource potential and natural environment on the other. The former equilibrium is functional, and circumscribed within the latter, which is structural; one is, therefore, internal, the other external. So

long as there is no transition from one stage of economic life to another, or no leap in the development process, there is a harmonious working of these equilibria individually and mutually. In the event of transition or leap, not only is there a change in the utilization of existing resources but the development of new resource-substitutes often in defiance of natural conditions or at an incomparable faster rate than the changes in economic life justify. These changes in the modes of production eventually effect the productive forces of society, and the more frequent they are, the greater the disturbances in resource equilibria. For example, in the primitive community there is one mode of production, in modern economy another. So are differences in modes of production in the pastoral and agricultural communities, rural and urban, and rural and industrial. Each of these modes of production represents a typical resource equilibrium, and any attempt at changing the characteristic mode of production will, by upsetting and readjusting productive forces, disrupt the normal resource equilibrium.

It follows, therefore, that economic life develops in harmony with the resource patterns available, and transitions from one state of economic development to another demand a reciprocal adjustment with the resource capacity of a region. This is amply illustrated by the localization of industries and regional division of labour. The character of industries, both in *primary* and *secondary* forms of production, reflects in a large degree the resource basis of localization. Primary production, *viz.* hunting, fishing, herding, lumbering, mining, and farming, is more or less localized due to the direct association of resources and location, and so long as the resource potential

permits, these industries will persist without any serious inclination towards transition. Secondary production, *i. e.* manufacturing, will develop wherever the resources of primary industries and manpower offer opportunities. Though the development of secondary industries in modern times depends more on cultural advancement of people than the mere availability of raw materials provided by primary industries, only those regions can be called economically strong which develop their secondary industries on their own bases of resource supply. When secondary industries are developed on the basis of imported raw materials, the comparative regional advantage in respect of climate and labour appears greater. For example, the iron and steel industry of Great Britain is localized because of such resources as metallic minerals, coal power, and energetic labour; but the cotton textile industry has a comparative advantage of all resources except raw material (cotton). Though in more complex stages of manufacturing, the location of raw materials and power makes relatively little difference, the availability of *human resource* and other environmental factors nevertheless assumes greater significance.

Business cycles too appear to depend largely on variations in quantity of mobilized resources. The most important and most variable of all man's material resources are vegetable crops. According to Jevons, economic crises occur owing to the periodic appearance of spots on the surface of the sun (*sun-spots*) affecting meteorological conditions, and through them harvests and agricultural production. Since agriculture (including plantations and animal husbandry) is the basic industry, all other industries and economic activities are affected in consequence. When crops are good, the

farmers have more to spend than in years of scarcity. More money is thrown into circulation, the factories get larger orders, transport becomes heavy, and commercial activities are stimulated. At the same time, other material resources, such as coal, iron, lumber, food-stuffs, and raw-materials are likely to be produced in unusually large quantities. In lean years there may be a very poor resource production and consequently a grave business crisis. These cycles of plenty and scarcity (in vegetable and animal resource production) follow precisely the $11\frac{1}{2}$ years *sun-spot* cycles, and are an index to periodical booms and slumps in business activity.

By far the closest relationship between Natural Resources and economic activities is apparent from the currents of commerce. The geographic basis of exchange is found in the appearance of (accidental or intentional) resource *surpluses*. Certain climatic regions produce their own characteristic resources, and create a surplus which other climatic regions purchase. Commercial currents, therefore, flow from regions of surplus to regions of deficiency through channels which are known as trade routes on land and sea. In the field of commerce, though the volume of business is determined by the activity of the people, the character of business is controlled by the quantity and variety of resource surplus. Normally, therefore, the chief currents of commerce flow between typical resource zones, *viz.* temperate regions and tropical regions, regions of primary production and secondary production, agrarian countries and industrial countries; and finally, between regions of characteristic primary production, or between regions of specialized secondary production, respectively. An analysis of the commodity classes exchanged

between these resource zones will at once indicate that the basis of modern commerce is a territorial division of labour. It is the comparative advantage in the production of resources in different climatic zones that determines the possibilities of international trade.

8

THE RESOURCE BASIS OF ECONOMIC STRENGTH

Modern world economy is today a resource hierarchy, that is, an hierarchical order in which strength and weakness are derived from the possession of Natural Resources underlying cultural development. The possession of resources, in fact, is the hypothesis of economic facts in the interpretation of economic conduct. It determines the source of all available materials and forces utilized in the satisfaction of wants. The degree to which resource patterns are mobilized (*i. e.* wealth produced) represents a state in virtue of which the economic well-being and progress of a people in a given region can be ascertained. This state is, accordingly, premised by the concept of Economic Strength, which indicates the capacity and ability of peoples to produce goods and services in general for maintaining and raising pleasurable life.

In quantitative terms, Economic Strength refers to the volume of support derived from numbers, equipment and magnitude of the potential resources already mobilized, and includes the probable potency under the *strain* and *stress* of productive forces at any one time. In qualitative terms, it refers to the range of selection and variation of effective resources in relation to practical utility, that is, the elasticity of available

resources in relation to urgency of wants, as between one time and another. The assessment of Economic Strength, therefore, involves both quantitative and qualitative measurements of mobilized resources, and refers to a well-defined region and a specified period.

The *capacity* to produce goods and services in general is indicated by the possession of Natural Resources, that is, a quantitative analysis of such data as the size of territory; areas devoted to forestry, pasturing, plantation, or agriculture; accessibility to conserved minerals; availability of power; size of human and animal population; and the magnitude of resources derived from other environmental aspects. These factors enable us to make some sort of estimate of the extent to which actual production of wealth is possible. The degree to which the potential resources for any specific purpose can be mobilized and utilized depends on the ability of people to produce the desired effects. This *ability* depends on a variety of factors, such as, the proportion of effective (working) to the total human population; the nature and type of goods and services which can be made available, and the length of time required to produce these goods and services in view of a given strain and stress of applied or available productive agents; the facilities or impediments, both in terms of space and time, influencing the transfer of resources from one kind of production to another with a view to imparting greater degrees of utility; the possibilities of adjustment between the relations of production in harmony with rapidly changing wants; the probability of expansion of the desired effect in relation to needs and exigencies; the adaptability of producers and consumers on the one hand, and the State and

society on the other, in regard to production policies; and not in the least, the will and intelligence of the people. These factors will enable us to find out how far actual production falls short of capacity, how it can be accelerated, or how far can it be curtailed to avoid waste, if any.

The Economic Strength of a people, measured in the quantum of wealth, *i. e.* effective resources, is a very ambiguous concept, for the strength available may to a very large extent depend upon the purpose for which it is used. It may imply the possession of certain area and quality of 'land,' indicating economic assets; the availability and continuity of such basic resources as food-stuffs and raw materials; the possibility to enjoy a state of self-sufficiency for meeting certain specific wants; the building up of a position to resist economic conflict and competition; the power to wage war for territorial expansion or to resist aggression in self-defence; the full employment of idle resources both in men and materials, and the raising of the plane of living in general as a measure of economic progress; the ability to produce surpluses for consumption in leisure or for determining the degree of rest; the acquirement and control of economic power, as a means of acquiring extra-economic power, political stability and social security. Whatever be the purpose of assessment underlying the various senses, one fact stands out prominent, namely, that Economic Strength is derived from the Potential Natural Resources that are manipulated and utilized at any one time for a specific purpose.

Inequality in Economic Strength has always existed in human communities. This is due to regional differences in resource patterns. We find different degrees of Economic Strength between

the peoples of the temperate zone and the tropical zone, the inhabitants of plains and regions of rugged relief, the occupants of littoral fringes and of the intra-continental tracts. Amongst the peoples of different civilizations, due to diversity in cultural apparatus applied to resource manipulation, marked differences in Economic Strength are noticeable, *e. g.* the peoples of vegetable civilization and machine civilization. Sharp contrasts are also noticeable in the Economic Strength of the fishing and the mining communities, the forest dwellers and the urban industrial workers, the shifting (nomad) tribal groups and the permanently settled agricultural communities. This has prompted the people of a *region*, or a *cultural group*, to assess their strength in relation to their neighbours, and in the event of disparity, to justify their claim on the earth's resources either by mutual bargain or through naked force.

Judged by the value of resources (in the modern system of price economy), the Economic Strength of people in the tropics is considered weaker than the energetic races of temperate lands; of machine civilizations greater than that of vegetable civilizations. The Economic Strength of Monsoon lands, or of the mining and plantation communities, lies midway. The reasons are obvious. In the tropics, Natural Resources are abundant but the energy and ability of the people permits of a limited resource manipulation and a slow accumulation of wealth. In the temperate regions, the high quality of energy and ability of the people enables them not only to mobilize their resources to the fullest capacity, but induces them also to reach distant tropical lands and to manipulate their resources for their own use. The people of machine civilizations equipped with better tools and

scientific knowledge, produce a comparatively greater quantity of wealth due to the high value attached to their products; whereas the people of vegetable civilizations, by producing primary (and generally high-volume low-priced) commodities cannot accumulate much wealth, and remain on the lowest rung of resource hierarchy. There is no denying the fact, that the vegetable civilizations of to-day are economically poorer than the industrial machine civilizations.

9

THE RESOURCE BACKGROUND OF POLITICAL GEOGRAPHY

There is a close relationship between Natural Resources and policies of nations. Of the many causes of political unrest—remote or isolated—the most prominent and immediate is the disruption of economic equilibrium, either in national life of a people due to improper resource distribution, or due to a widening disparity in the possession and utilization of Natural Resources amongst the nations of the world. But, while the direct causes of political disturbances may be found in economic differences—the differences which indicate the degree of possession and control of Natural Resources outside the home-region—the indirect or ultimate cause lies in geographical differences which themselves are the source of all economic differences. Thus the origin of boundary disputes, territorial resettlements, regional commercial competition, and colonial rivalry, may be found in the desire to possess and control a portion of the world's resources far in excess of the normal and reasonable needs of a people. Ignorance of this fact, or a failure candidly to admit it, has been responsible for many political conflicts leading inevitably to wars, and for misguided and wasteful efforts toward a co-operative conquest of nature and the establishment of enduring

peace and prosperity.

There is no denying the fact that energy resources and essential raw materials are not equally, at least proportionately, distributed on the earth's surface. Nations favoured geologically and climatically tend to shape their policies for conserving, developing and even monopolizing Natural Resources within their own borders and for their own benefit; while nations poor in them aspire for colonies, "spheres of influence," or guarantees of essential foodstuffs and raw materials for building up a powerful economic state as an instrument of securing a position of influence in the comity of nations. The geographical causes of resource difference tend in the long run to exercise a dominating influence in moulding the political outlook of the peoples and their government, and stand as the fundamental basis of world conflict and chaos in modern times.

A historical approach to the study of modern wars unfolds a record of political encroachments of one nation into the geo-economic zone of another. This is either made possible by a systematic infiltration of capital investment, or brought about by the application of naked (military) power. The motives that impel either private capitalistic enterprise or military expedition to develop or appropriate distant and frequently inhospitable territories are not only accessibility of raw materials—minerals and commercially useful forms of plant and animal life—but also the exploitation of the native peoples who provide both a cheap labour supply and a market for manufactured goods. The most striking example of such policy is, perhaps, contemporary Africa—the entire continent being under the domination of Imperialist nations or parcelled out into "spheres of influ-

ence." Though a small proportion of the continent of Asia has been acquired by Imperialist nations some of the richest tracts are possessed by Great Britain, Holland and Japan. It is the commercially unprofitable or poor Resource Areas like Afghanistan and central Arabia that have retained something like independence. For most of half a century the European nations and the United States were partitioning off and exploiting China quite amicably, but they have now to face the territorial ambitions of Japan. The Baltic States and the Balkan Tracts have from times immemorial been a bone of contention alike for Germany and Russia on the one hand, and the intra-continental and extra-continental European powers on the other. The re-distribution of world's Resource Areas after the Global War will no doubt disclose the latent motives of the nations warring without any provocation. The domination of China as a source of raw materials, or as sphere of influence by the U. S. A., could never be justified on ethical or humanitarian grounds; while the destiny of millions of Indians, Indo-Chinese and Indonesians, clamouring for freedom, is still shrouded in the mysterious motives of Imperial Britain, France and Holland.

The danger of conflict among the exploiters over colonies and zones of influence is made much greater by the existence of a number of industrially advanced nations which, for various reasons, do not possess the lands to which their capital might be profitably employed. These "unsatisfied" nations are ruled by governments, an integral part of whose foreign policy is the acquisition of overseas territories for development. Thus in Abyssinia the Italians attempted to extract minerals and to cultivate cotton and other raw materials, and it was mainly greed for minerals that prompted the

Japanese to violate the integrity of Mongolia. The utter dependence of British industries on Indian raw materials is another strong argument for the perpetuation of serfdom of the peoples of India under the un-Christian British yoke. A clue to the aggressive technique of the Nazis (German National Socialists), is found in the development of such philosophies as '*encirclement*,' '*living space*,' '*geopolitics*,' etc., and Germany's demand for the return of its former colonies from the Mandatory Powers, chiefly Great Britain and France, speaks for itself. In its absorbing search for profits, the machine civilization tends to maintain peoples of vegetable civilization (cultivators and plantation labourers) under perpetual subjection. It also neglects peoples that do not fit into its scheme of exploitation, and dooms them to atrophy, sometimes to extinction. Millions of peasants in India, China, and South America are to-day condemned to the most wretched poverty, to disease, malnutrition, starvation, unemployment, and not unoften to premature death.

Machine civilizations, moreover, are possessed with a drive toward expansion which leads to colonial rivalries between competitive industrial nations, to aggressive foreign investment policies, and to armament rivalry and other concomitants of imperialism. Before this drive agricultural countries are relatively helpless: their resource pattern is inherently weaker than that of the industrial countries, at least in a world-wide price economy. When a highly industrialized nation approaches the verge of resource exhaustion—this is particularly true of mineral power and basic metals—or needs larger quantities of resources which its existing territory and colonies cannot supply, it oversteps the conventions laid down by

International Codes and overlooks all norms of social justice. There are often dissensions among the exploiters, but they are able to arrive at a convenient settlement about the division of spoils, and thus the nefarious activities of the one are encouraged by the other. The condonation by the European Capitalist Governments, led by Great Britain, of the Italian conquest of Abyssinia was the latest example. When, however, the aggression of a capitalist nation upon a peaceful country jeopardizes the interests of another, or is likely to give the aggressor a new power which in future might prove dangerous, the clash of interests leads to inevitable conflict, and World Wars I and II, as correctives of Balance of Power, are testimonies to these contentions.

The political aspect of the geography of Natural Resources is exemplified by the vast areas that have been appropriated by leading imperialist nations, so as to provide their capitalists with profitable fields of expansion. Tropical and subtropical lands have been most affected, but no continent, no geographical region, has been entirely free from this malign phase of machine civilization. One of the main results of the political and economic processes of capitalism and imperialism, then, is an indiscriminate and ruthless exploitation of rich 'lands' (Resource-Areas). In many regions, the world's most valuable resources are being recklessly squandered; elsewhere, destructive exploitation has ceased, but there is experienced the colossal waste of over-production. Wherever or whenever there are the slightest signs of obstruction from the peoples of the exploited regions or their governments, the imperialist machinery immediately pursues a war of colonial aggression or exercises political power over profitable

Resource Areas. Each nation of the world to-day, which lacks Natural Resources sufficient for its existence or progress, strives to carve out "spheres of influence" in different corners of the globe, and so political boundaries are created along resource boundaries. A new political Geography is now in the making, and that is, in all its essentials, a political control of *basic* Natural Resources. Since economic life pulsates within regional framework, and Economic Strength implies the possession of more wealth than is necessary for the normal needs of a nation, the aim of this modern Political Geography lies in the possession and control of those Resource Areas only, wherever they may lie or however they may be acquired, which enable a nation to build up the greatest Economic Strength

10

THE RESOURCE CRITERION OF SOCIAL PROGRESS

Human culture is a product of man's reactions to environmental stimulus. It has been attained only by the prolonged struggle of man for a more satisfying mode of life. Out of this struggle progress has come.

The physical environment has played a large and very important part in the origin and development of culture, in that it supplied the material bases upon which every culture had to draw, and, by supplying certain resource patterns and denying others, it offered to every people a series of opportunities for cultural advancement on divergent lines. It formed the essential foundation on which a large proportion of the discoveries and inventions of a people have been made; and with the materials supplied, and under the varying conditions of life which the environment strongly suggested, the genius of the people resident there evolved most of the basic features of its culture. Since the sub-structure of any civilization is the material fabric that frees mankind from the status of the savage, it follows that every civilization must depend in large measure upon its geographical environment (*i. e.* mountains, plateaux, plains, rivers, seas, soil and sub-soil, climate, vegetation, and animal life), the state of its tools and industries, the ability of

its people, and the organization of society for the direction of industry and social control.

The history of civilization is largely a history of the progressive appropriation by mankind of the various resources of the physical environment. Since the evolution of human culture depends on the development of man's ability to control and utilize the earth's material and energy resources, certain conditions are essential for active adaptation. MacCurdy (*Human Origins*) mentions three factors which distinguish man's superior physical apparatus from the anthropoid's, viz., an effective and powerful hand, a large brain and superior mental capacity, and a well developed stereoscopic vision. With these three factors, a combination that probably came into play in the late Tertiary epoch, culture inevitably followed, and man has since become an essentially culture-building animal. Everything that man has made is directly or indirectly the product of his hand, directed by its inseparable guide, the brain. "There can be no doubt," says Ellwood (*Cultural Evolution: A study of Social Origins and Development*), "that the development of the brain, and specially of the intelligence, has been closely correlated with the development and use of the hand. The superiority of the human brain, as we have seen, is a development which comes through use. The use of the hand in making and manipulating tools implies the use of the brain. Consequently the use of the hand has reacted upon the development of the brain and has been one of the foundations of cultural evolution." In the exploitation and utilization of Natural Resources the brain and the hand have achieved their marvellous results together, and the most useful art acquired by man is the ability to record his ideas, and achievement in writing, which together with

the arts and crafts, has become the cultural heritage of generations.

We do not know exactly how the first steps toward civilization were taken. Man emerged so slowly from the animal stage that no specific beginning of culture can be given. Very often mere chance, or accident, in the sense of unintended or unexpected result, has marked the creation of culture trait. But even the earliest *drives* in culture-building, without any question, must have been man's first concern for food, safety, and reproduction. Man could not have arrived at the human level of physical evolution without having learnt a good deal about Natural Resources in food (fruits, roots, berries, fish and animals), shelter and safe sleeping places (trees and caves), and rudiments of language (modulations of voice, or natural expression of ideas and emotions through gestures). Later came the very earliest implements and weapons, *e.g.* sticks, stones, flints and bones, as they were found in nature. Advances in the technique of resource utilization were associated with other phases of culture, which developed language, art, morals, religion and government.

In the history of cultural evolution, the three generally accepted stages are Savagery, Barbarism and Civilization. In the first stage, *viz.* *Savagery*, man's progress expressed itself mainly through his success in satisfying his primary physical needs. Man was a creature of his all-powerful and dominating environment, and learned to want what he found in his immediate neighbourhood. The main sources of wealth were of vegetable and animal origin, and the human hand was all-important. In this primitive stage of Collectional Economy, progress was judged in terms of quantity and con-

tinguity of food resources in particular, and clothing and shelter in general. Culturally, there was no development of *symbols*, though tools of the Stone Age had become common. The principal achievements of man in this stage were the making of rude stone picks, scrapers, knives, probably wooden handles; the use of fire and the making of pottery and the bow; carving implements, and the use of bones. Hunting and fishing had developed, but not cultivation. This period also marked the development of Nature Cult, with its many superstitions and rituals.

In the second stage, *viz. Barbarism*, man gained a certain degree of freedom from the domination of natural forces, and exercised an increasing mastery over materials, plants and animals that belonged to his habitat. Progress was judged from surpluses of food resources, and non-food materials (particularly for enjoying some degree of comfort and rest). Stone tools were made by grinding and polishing. Improvements in pottery and dwellings, the invention of weaving and plaiting, and the art of painting and decoration, were the main achievements. This stage represented a cultural nomadic economy.

The third stage, *viz. Civilization*, is divided into two distinct periods: (1) Pre-Mechanical, (2) Scientific-Mechanical. In the Pre-Mechanical stage, agriculture had developed, giving rise to permanent rural settlements. The use of metals (bronze and iron), and the growth of literacy gave rise to town economy. The Bronze Age was the beginning of modern civilization. With it came, brick, masonry, bronze tools and ornaments, architecture, walled towns, sculpture, the plough, the wheel, the chariot, domestication of the horse, irrigation, sailing, and the true art of writing.

Great progress was made in the use of iron. Metals replaced stone for tools and implements, and with metallic tools the exploitation of Natural Resources increased considerably. Man roamed farther in quest of new resources, and accumulated large surpluses of wealth which gave him increased economic prosperity and leisure. With the Iron Age came road-building, coinage, vehicles, crop rotation, fertilizers, architecture, commerce, and stable government. Religion and Ethics reached a high stage of development, and methods of warfare became more effective. Arts and crafts, painting, music, sculpture, rituals, fashions, ceremonies, public utilities, social organization, political administration—all were improved, and man's progress, both materially and socially, reached a new mark of achievement.

In the later period of civilization, there was perfect language (symbols for writing), and permanent records could be maintained. Here the achievements of man were greater still, and the utilization of Natural Resources unsurpassed by any previous stage. The development of world-wide navigation, mechanical and commercial agriculture, power-driven machinery and mass production, the introduction of currency and exchange on an international basis, led to a system of metropolitan economy. With the use of metallic and non-metallic minerals, the harnessing of natural power resources, the advancement of scientific knowledge, and the invention of a multitudinous variety of instruments and appliances for dominating the forces of nature, the whole world has become a source of wealth and aggrandisement for man. Culturally, man's superior material equipment, for the *telic* exploitation and utilization of the Natural Resources over a greater

part of the earth, makes him the master of his environmental situation. The scope of man's social progress has broadened with the accumulation of knowledge, and his creative powers have found no limits yet.

Though transition from the ancient primitive to the modern civilized stage is very slow and gradual, there is no uniform process of social evolution amongst societies possessing different racial talents or placed in dissimilar environments. The development of genuinely new culture traits, their accumulation into a culture complex (*i. e.* a group of related culture traits that go together), and finally, the degree of cultural change, depend on the availability of natural resource-patterns in a given environment. The conditions behind cultural invention and the social progress of earlier societies, as well as the progressive stages of civilization, are suggestive of three factors, *viz.* a felt need of society, the proper physico-geographical base, and the requisite ability of the people for invention.

The invention of culture trait, as a result of some felt need in human society, reflects in a marked degree the resource patterns of a habitat and the inborn qualities of the people utilizing them. Compare, for example, the material culture of two hunting communities, *viz.* the Eskimos of the Tundra ice-desert, and the Veddas of Ceylon (hot-wet tropical island). The environment of the Eskimo is poor in materials, and so his few tools and weapons are made of bones, teeth, tusks, or perhaps stones. The Veddas, with a variety of vegetable and animal resources, both terrestrial and marine, display better knowledge and art in making tools and weapons from a variety of materials, such as, stones, hard-wood, bamboos,

shells, tusks, bones, and metals. Moreover, in diversity of design, range, and effectiveness, the Vedda's tools and weapons outclass the poor implements of the Eskimos. In matters of tribal organization, social cohesion, and economic prosperity, the Eskimos have remained the least progressive. A monotonous landscape of frozen beauty, a rigorous climate, short summers, and the absence of large floral forms in the Tundras, stand in sharp contrast with the steaming heat, the rich floral and faunal kingdoms, and the tropical scenery of myriad colour and beauty characteristic of Ceylon. Hence the difference in the influence of the environment on the material and social progress of the Eskimos and the Veddas. Since the development of culture is attributed as much to racial qualities as to regional potentialities, it is possible that in the event of considerable disparity in the ability of people, or the possession of Natural Resources, cultural evolution may proceed on divergent lines, and progress may be baulked or accelerated accordingly. There may also develop a *lag* between the material traits and adaptive non-material traits in the same society undergoing a social change. Peculiarities of the habitat and the means of cultural diffusion, may also result in a great diversity of domestic, economic, political, religious and social organizations.

The geographic interpretation of the history of progressive manipulation of Natural Resources, and of the development of indigenous civilizations in the Old World, admits of three distinct epochs, *viz.* the River-Valley Period, the Inland-Sea Period, and the Oceanic Period. From the earliest days of man until about three thousand years ago was the 'River' period. On alluvial lands in the fertile river-valleys agriculture developed, and the

resulting security of food-supply fostered man's progress materially, intellectually and spiritually. The most ancient recorded civilizations lay in the valleys of the Nile, the Indus and the Euphrates, and the somewhat later civilizations of Assyria, Palestine and Phoenicia grew under similar conditions but with sea contact.

With the evolution of the arts and industry boat-building improved, and the Mediterranean became the medium of human intercourse. Here began the second era of cultural progress. The earliest voyagers were the Phoenicians, who by force of circumstances became middlemen for the resources of the East (e. g. spices, pearls, ivory, and ebony from India; and silk, cotton, and precious stones from China) between the Babylonian peoples and the West. Next came the Carthaginians, the Greeks, the Romans—all equipped with a high degree of intellectual development and stimulated by invigorating climate—who broadened the sphere of resource manipulation and utilization, and the progress of whose civilizations was accentuated by sea contact. By the middle ages, the resources of the Mediterranean regions were fully mobilized and distributed far and wide to inland communities, and the diffusion of Mediterranean civilizations to the east and the west was facilitated by trade contacts.

When the Turks captured Constantinople in 1453, the Mediterranean trade with the East came to an end, and the third era of progress began. It was for geographical reasons that the seaboard countries of Europe became prominent and influenced a wider world. The Mediterranean countries having no direct contact with the ocean sank in importance. Neither for a long time did the northern and eastern Europe make any notable

contribution to the world's progress. With great advances in astronomical knowledge, skill in navigation and ship-building, the Atlantic Ocean became the centre of activities. The pioneers of ocean travel were the Portuguese, who came in contact with Africa, India and China, and soon secured a monopoly of eastern trade. The varied resources of these rich and prosperous lands contributed to the wealth of the Lisbon merchants. With the discovery of America in 1492 a great impetus was given to ocean trade. Then appeared the Dutch—a people of fertile lands of the Rhine delta, and endowed with high degree of culture, dense population, and increasing wants—in open rivalry with the Spanish for the far-eastern trade. They gradually obtained possessions in the East Indies, and mobilized intensively the marine, mineral, forest, plantation, agricultural, and human resources of these regions. Through them were introduced material traits of western culture in the Far East. In the earlier half of the eighteenth century appeared the British adventurers on Atlantic waters. Dazzled by the prosperity of the Spanish and Dutch traders, and lured by the potential wealth of India and the far-eastern Resource-Areas, the British staked their all to wrench the eastern trade from the hands of European rivals. With British commerce, as was natural and to be expected, came the 'flag,' hoisted on modest gunboats, and streams of culture traits followed thereafter which to this day lie unassimilated and repugnant to the spiritual East. The history of European domination of the Orient is apathetic story of indiscriminate exploitation of Natural Resources (both materials and men), and the retrogression of oriental culture may largely be attributed to the draining away of their

resources and the consequent disintegration of their social institutions. The penetration of Occidental traits into Oriental areas has neither brought material prosperity, nor has it stimulated social progress.

There is no denying the fact that the cultural progress depends on the intimate relationship between race and habitat. Relatively stable physical and mental characteristics of large populations emerge as a consequence of climatic selection and organic adaptation to the requirements of survival in a given geographical environment. Racial traits so differentiated are the primary creative factors of all civilizations, past and present. The quality and the temper of a culture, and the pace of social progress have also been conditioned by racial contacts and conflicts over uncounted millennia of human history. Triumphant races have imposed their wills upon the conquered, and elaborated the social, political, and economic organs of control, exploitation and domination.

But the character of races is also conditioned by such geographic factors as climate, soil and food resources. The cultural pattern and social progress of equally talented races in dissimilar habitats can easily be contrasted. It is highly probable that differences in climate and Natural Resources in the Egyptian and Babylonian delta-regions explain to a certain extent the more impressive and brilliant achievements of the Nile civilization. The climatic conditions of the Nile delta were more favourable to the release of energy, sustained activity, and correspondingly productive achievement than those of the Plain of Shinar. Buckle contrasts the literature, mythology, religion, and art of the ancient Greeks with those of the ancient Hindus. These differences are explained

from the point of view of the physical aspects* of environment. With low mountains, small rivers, clear sky, dry temperate climate, less frequent earthquakes, storms or droughts, nature in Greece is less terrifying, less dangerous and less mysterious than in India. Accordingly, the human mind is less alarmed, less appalled, and less superstitious in consequence. In spite of the scanty Natural Resources, an invigorating climate gave the necessary push that carried Greek culture forward, whilst the abundance and diversity of Natural Resources were, owing to an enervating tropical climate, instrumental in holding Indian culture from spreading into wider peripheral areas. Moreover, as the tendency of Indian culture was to widen the distance between man and nature, in Greek culture the tendency was to diminish it. Consequently, the Greek gods had not only human forms, but human attributes, human interests, and human tastes; and so close was the relationship between the human and the divine, that not unoften mortals were deified. With faith in his own power, as distinguished from submission to the powers of supernatural agents characteristic of India, man made a greater material progress in Greece toward the conquest of nature. The feelings of helpless dependence and abject subservience to the dominating powers of Nature in India, stand in striking contrast, because with the richest gifts of Natural Resources, and the consequent contentment, progress in India was measured in terms of non-material traits upon which alone human destiny could finally rest. The spirit of inquiry, the stimulation of rational faculties, scepticism, and scientific materialism were developed to a higher degree among the Greeks, than among the Indians, whose imagination was more tempered, more restrained, and

more refined. There can be no doubt that physico-environmental factors played a decisive role in determining the cultural differences of Greece and India; and in the ultimate analysis the social progress of all races will be found promoted or retarded by the availability of Natural Resources.

It follows, inevitably, that all universal culture complexes, *viz.* language and communication; food, clothing and industrial arts; family ties and social institutions; ideas and beliefs; ceremonies, rituals, customs, manners and traditions; codes of behaviour for individuals and organized social groups; fine arts and sciences, public utilities and civic administration; war and diplomacy; economic and commercial organizations; and the entire material and non-material heritage of man, are evolved and developed in regional framework. Analysis of culture complexes shows that the invention of each culture trait is due to the felt need of adaptation to a given geographical milieu, and only those traits which grow in harmony with the physical aspects of nature tend to survive and accumulate for the heritage of generations.

The resource relationship of culture complex and social progress is evident from the fact that the inventive genius of nations tends to operate along the lines laid down by resource patterns. The use of bones in the Arctic snow-deserts, of stones and metals in regions of rugged relief, of wood in tropical and temperate forest areas, and of shells in coastal fringes, are a few basic examples. The sculpture of Greece, the painting of Italy, the music of India, the military complex of Germany, the trade complex of Great Britain, the mummy cult of Egypt, and the ancestor worship of China need no comment. The labour-saving devices of highly advanced machine civilizations, the control

of energy resources, the coal and iron complex, a highly developed system of banking and commerce, and a technique for subjugating the people of vegetable civilizations, are too significant culture complexes of the twentieth century industrial civilizations to be ignored. The exhaustion of Natural Resources, an ever expanding population and diminishing food supply, a growing industrial prosperity dependent on imported raw materials, and the decay of moral forces and social control (which has made man more free to revert to the law of the jungle and commit pillage and plunder), all these drive men to-day toward a new goal—not poetry, not philosophy—but, the Material Kingdom of Man, in which the endless adaptations of the machine can best serve the preponderantly material aspects of civilization. A dispassionate analysis of ancient and modern civilizations shows, in unmistakable terms, the ascendancy of the material culture of the disdainful present over the spiritual culture of the glorious past.

The fact that in many parts of the world there exist remains of civilizations, which have long since passed away, is one which cannot fail to be recognized. There are records and remains of Egypt and Babylon, of Greece and Rome, of India and China, and several other glorious culture-areas all over the earth. These civilizations have decayed and disappeared. There are no evidences of the golden epochs, when man was thought to have been more clever and better than to-day; for, like individuals, 'nations have their day.' A more plausible explanation is that the history of human progress is as much one of progressive rise, as one of progressive decline. If Nature rears and nourishes man in her lap, she also frowns upon him at times and brings down destruction and ruin.

Since the foundations of all civilizations lie deep in the roots of Nature, their survival and continuity are ensured so long as man works in harmony with his environmental milieu. The decay and destruction of civilizations, in the long run, must be attributed to three causes: (1) inadequate manipulation of resource potential, (2) indiscreet utilization of available resources, or (3) indiscriminate exploitation of Resource Areas, resulting in colossal waste. There are ample facts to support this contention. The decline of the Chinese civilization has been explained in terms of soil erosion; the decay of Greek civilization was due to inadequate resource potential, the limit of resource utilization having been reached much earlier than the climax of intellectual traits of culture; the fall of Rome has been attributed to declining rainfall and indiscreet manipulation of resources; whilst the downfall of the Indus Valley civilization is due to the combined effect of such causes as the shifting of the river-bed, diminution of rainfall (due to reckless denudation of forested lands), encroachments of the Thar desert and the extension of salinity from Cutch tracts, impoverishment of the soil, and above all, an indiscriminate exploitation of vegetable resources leading inevitably to the impoverishment of faunal forms.

The machine civilizations of to-day, firmly rooted in Great Britain and Japan, are built upon the resources of colonies and dependencies. They are doomed to decay once the free flow of the raw materials is withheld by exploited countries, for the Natural Resources of these machine civilizations are too meagre to ensure any degree of self-sufficiency and independent progress. The new and balanced machine-cum-vegetable civilizations of America and Soviet Russia, however, with their

immense quantity and variety of Natural Resources (both in materials and men), might survive a longer period of the twentieth century, provided that their arts and sciences are employed, and their labour directed, not only to the controlling of flood, drought, pestilence, and famine, but to the replenishing of the earth, and the conservation of the available supply of both mobilized and mobilizable resources. Social progress, no doubt, comes with the evolution of culture complexes, but it stays only so long as Natural Resources permit the effective mobilization of potential Economic Strength.

It now becomes our task to summarize the process and measurement of social progress. We have seen that even in the earliest forms of human society culture is evolved and developed. Our evidence further indicated that each society produces a culture complex which reflects the physical conditions of the habitat. With the accumulation of culture traits, and the enrichment of culture complex in consequence, a society tends to make social progress. "The basic process of cultural change," says Chapin (*Cultural Change*), "is one of accumulation," but progress comes only when cultural change is in the desired direction. The civilized peoples of the past have not continued indefinitely to progress, or even to maintain their civilization, there being periods of rise, of splendour, and then of decay. Sir Flinders Petrie (*Revolutions in Civilization*) said, "every civilization of a settled population tends to incessant decay from its *maximum* condition; and this decay continues until it is too weak to initiate anything, when a fresh race comes in, and utilizes the old stock to graft on, both in blood and culture. As soon as the mixture is well

started, it rapidly grows on the old soil, and produces a new wave of civilization."

It is often assumed that decay in civilization is due to the conquest of a people by a more virile and intelligent race. Far from it, a civilization dies its own natural death. This is brought about by changes in resource manipulation and utilization. Where people fail to control nature, and manipulate its resources for their increasing wants, a limit to their abilities is said to have been reached. Here Nature looks niggardly, and often hostile. The climax to cultural progress having thus reached in a given habitat, man stretches his artificial tools far and wide, and often seems temporarily successful in obtaining such resources as comprise the warp and woof of his life and glory. Progress continues till such resources are available regularly and adequately, but again there comes the limit, which when unsurmounted, results in the downfall of the ruling man, 'The old order changeth, yielding place to new,' and out of the remains of the decayed civilization grows another more pointed and perfect one than its predecessor. The civilization of ancient Egypt rose and fell, but out of its remains there grew still greater ones in the Mediterranean regions. The decayed Greek, Roman, Chinese, and Indian civilizations have resurrected in new patterns in the civilization of to-day, and we can trace obvious traits of ancient civilizations though in more useful and perfect forms.

The modern civilization is indeed a product of natural progress of social evolution, which has emerged as the result of a series of historical adaptations of races to their physical environments. In the fourth millennium B. C. the civilization of south-west Asia made a number of discoveries

and inventions, *e. g.* corn-growing, cattle-breeding, metal-working, the wheel, the sail, the loom, the brick, which when diffused, transformed the majority of mankind from wandering food-gatherers to settled food-producers. There have been other ebullitions of civilization in Greece, in Rome, in China, in India, and elsewhere, from which mankind derived most of the other elements (*e. g.*, arts, crafts, literature, and material culture traits, as their resource patterns stimulated). The growth of the world's population, the depletion of many aspects of Natural Resources, the multiplicity of human wants, the inter-connection of countries by rapid means of transport, and the shifting of social and political ideologies—all have led to the growth of a unique Western Machine Civilization, which is more adapted to manipulate and utilize the resources of the greater part of the earth. By means of steam, electricity, machinery, utilitarian arts and sciences, and many discoveries and inventions, it has increased the wealth and material welfare of mankind, and transformed human life completely. But the chief difference between the ancient ebullitions of civilization, and the modern ebullition, is that, whereas the former was primarily spiritual and less material, the latter is essentially material and less spiritual. This fundamental difference can be traced both in the character of the environment where civilization was cradled, and the composition of resource-patterns which formed its warp and woof. All ebullitions of civilization, as a rule, in Regions of Effort, Arrested Development, and Lasting Difficulty, have largely been secular; all others in Regions of Bounty and Increment, mainly spiritual.

Civilization, then, far from being a static

concept, is a dynamic system. It is a process of culture accumulation and diffusion. It does not emerge abruptly, something out of nothing, but grows out of the sub-structure left behind by successive streams of human race. As an expanding and developing social system, each new civilization accommodates and assimilates (in original or modified form) the old traits, and invents the new. The greater is the utilization of Natural Resources by a civilization, the more complex becomes its cultural pattern, and the wider its scope and diffusion. But history tells us that no civilization has ever become universal. Since each civilization is composed to a large extent of endemic culture traits, stimulated by the character of physical environment and available resource patterns, it becomes pre-eminently suited to the progress of people in the original or similar habitats. Regions with typically different environments and resources themselves become distinct culture-areas, and after assimilating certain traits of other cultures, tend to evolve characteristically new civilizations. This is borne out by the fact that in spite of centuries of give-and-take and culture-contact, the East remains essentially spiritual, the West largely material. Moreover, no civilization dies altogether, it lies dormant and submerged till reconstructed. Since every habitat, given the conditions of culture-invention, fashions its own civilization, the problem of social progress lies not in supplanting a decaying or dormant civilization, but essentially in reconstructing it on new modes, norms and measures. This can be brought about by such discoveries and inventions as help to make ever greater and newer uses of potential resources hitherto unknown.

The Natural Resources of the Regions of

Bounty stand in sharp contrast with those of the Regions of Effort, of the Regions of Increment with those of the Regions of Lasting Difficulty; because each Resource Area requires a characteristic culture for its greatest development. Social Progress comes when each such Resource Area admits of the fullest manipulation and utilization of its resources for the greatest happiness of the greatest numbers. Therefore, considering the process of Cultural Evolution as a continuous and connected phenomenon, and Civilization as a response to regional stimuli in a circumscribed geographical area, certain underlying conditions of Human Progress should be: fundamental adjustments in culture complex in accordance with changing needs and times; full mobilization of Natural Resources for gaining the maximum Economic Strength; control of population, both quantitatively (by birth-control) and qualitatively (through eugenics), with a view to equilibrating resource production and consumption; social education and organization for the fullest development of personality, and the cultivation of leadership; freedom of expression and action for the promotion of discovery and culture invention. Since material and social inventions are the unpredictable mutations in human culture, they will seek largely their own course under the stimulus and stress of environmental factors, but they could certainly be encouraged by social effort.

By far the most important condition of social progress lies in the conservation and development of Natural Resources. National policies in regard to the exploitation of resources and social control in respect of their utilization, are *a priori* restrictive measures in resource conservation in times of peace or war, in boom or slump, and in periods of

resource contraction or expansion. Thus the stability of civilization and the degree of social progress depend not only on the quantum and kind of resource potential, but on the ways and means of their utilization, conservation, and development.

"History may be servitude,
History may be freedom. See, now they vanish,
The faces and places, with the self which, as it
could, loved them,
To become renewed, transfigured in another
pattern."

—T. S. Elliot.

ADDENDUM

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